Life Scope N
BEDSIDE MONITOR

OPV-1500K

0614-007018

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GENERAL HANDLING PRECAUTIONS

This device is intended for use only by qualified medical personnel.
Use only Nihon Kohden approved products with this device. Use of non-approved products or in a non-approved manner may affect the performance specifications of the device. This includes, but is not limited to, batteries, recording paper, pens, extension cables, electrode leads, input boxes and AC power.

Please read these precautions thoroughly before attempting to operate the instrument.

1. **To safely and effectively use the instrument, its operation must be fully understood.**

2. **When installing or storing the instrument, take the following precautions:**
   (1) Avoid moisture or contact with water, extreme atmospheric pressure, excessive humidity and temperatures, poorly ventilated areas, and dust, saline or sulphuric air.
   (2) Place the instrument on an even, level floor. Avoid vibration and mechanical shock, even during transport.
   (3) Avoid placing in an area where chemicals are stored or where there is danger of gas leakage.
   (4) The power line source to be applied to the instrument must correspond in frequency and voltage to product specifications, and have sufficient current capacity.
   (5) Choose a room where a proper grounding facility is available.

3. **Before Operation**
   (1) Check that the instrument is in perfect operating order.
   (2) Check that the instrument is grounded properly.
   (3) Check that all cords are connected properly.
   (4) Pay extra attention when the instrument is combined with other instruments to avoid misdiagnosis or other problems.
   (5) All circuitry used for direct patient connection must be doubly checked.
   (6) Check that battery level is acceptable and battery condition is good when using battery-operated models.

4. **During Operation**
   (1) Both the instrument and the patient must receive continual, careful attention.
   (2) Turn power off or remove electrodes and/or transducers when necessary to assure the patient's safety.
   (3) Avoid direct contact between the instrument housing and the patient.

5. **To Shutdown After Use**
   (1) Turn power off with all controls returned to their original positions.
   (2) Remove the cords gently; do not use force to remove them.
   (3) Clean the instrument together with all accessories for their next use.

6. **The instrument must receive expert, professional attention for maintenance and repairs. When the instrument is not functioning properly, it should be clearly marked to avoid operation while it is out of order.**

7. **The instrument must not be altered or modified in any way.**

8. **Maintenance and Inspection:**
   (1) The instrument and parts must undergo regular maintenance inspection at least every 6 months.
   (2) If stored for extended periods without being used, make sure prior to operation that the instrument is in perfect operating condition.

(3) Technical information such as parts list, descriptions, calibration instructions or other information is available for qualified user technical personnel upon request from your Nihon Kohden distributor.

9. When the instrument is used with an electrosurgical instrument, pay careful attention to the application and/or location of electrodes and/or transducers to avoid possible burn to the patient.

10. When the instrument is used with a defibrillator, make sure that the instrument is protected against defibrillator discharge. If not, remove patient cables and/or transducers from the instrument to avoid possible damage.

WARRANTY POLICY

Nihon Kohden Corporation (NKC) shall warrant its products against all defects in materials and workmanship for one year from the date of delivery. However, consumable materials such as recording paper, ink, stylus and battery are excluded from the warranty.

NKC or its authorized agents will repair or replace any products which prove to be defective during the warranty period, provided these products are used as prescribed by the operating instructions given in the operator's and service manuals.

No other party is authorized to make any warranty or assume liability for NKC's products. NKC will not recognize any other warranty, either implied or in writing. In addition, service, technical modification or any other product change performed by someone other than NKC or its authorized agents without prior consent of NKC may be cause for voiding this warranty.

Defective products or parts must be returned to NKC or its authorized agents, along with an explanation of the failure. Shipping costs must be pre-paid.

This warranty does not apply to products that have been modified, disassembled, reinstalled or repaired without Nihon Kohden approval or which have been subjected to neglect or accident, damage due to accident, fire, lightning, vandalism, water or other casualty, improper installation or application, or on which the original identification marks have been removed.

In the USA and Canada other warranty policies may apply.

EMC RELATED CAUTION

This equipment and/or system complies with the International Standard IEC60601-1-2 for electromagnetic compatibility for medical electrical equipment and/or system. However, an electromagnetic environment that exceeds the limits or levels stipulated in the IEC60601-1-2, can cause harmful interference to the equipment and/or system or cause the equipment and/or system to fail to perform its intended function or degrade its intended performance. Therefore, during the operation of the equipment and/or system, if there is any undesired deviation from its intended operational performance, you must avoid, identify and resolve the adverse electromagnetic effect before continuing to use the equipment and/or system.

The following describes some common interference sources and remedial actions:

1. **Strong electromagnetic interference from a nearby emitter source such as an authorized radio station or cellular phone:**
   Install the equipment and/or system at another location if it is interfered with by an emitter source such as an authorized radio station. Keep the emitter source such as cellular phone away from the equipment and/or system.

2. **Radio-frequency interference from other equipment through the AC power supply of the equipment and/or system:**
   Identify the cause of this interference and if possible remove this interference source. If this is not possible, use a different power supply.

3. **Effect of direct or indirect electrostatic discharge:**
   Make sure all users and patients in contact with the equipment and/or system are free from direct or indirect electrostatic energy before using it.

4. **Electromagnetic interference with any radio wave receiver such as radio or television:**
   If the equipment and/or system interferes with any radio wave receiver, locate the equipment and/or system as far as possible from the radio wave receiver.

If the above suggested remedial actions do not solve the problem, consult your Nihon Kohden Corporation subsidiary or distributor for additional suggestions.

In IEC 60601-1-2 Medical Electronic Equipment, Part 1: General Requirements for Safety, 2. Collateral Standard: Electromagnetic compatibility-Requirements and test. Section 36. 202. 2 Radiated radio-frequency electromagnetic fields, PATIENT COUPLED EQUIPMENT and/or SYSTEMS applicable IMMUNITY test methods are under consideration at SC62A/WG13. The 3 V/m IMMUNITY level may be inappropriate especially when measuring SpO_2 because physiological signals can be much smaller than those induced by a 3 V/m electromagnetic field.

When measuring SpO_2, various interference may produce false waveforms which look like pulse waveforms. SpO_2 value and pulse rate may be measured from these false waveforms, causing the alarm to function improperly.

When installing the monitor, avoid locations where the monitor may receive strong electromagnetic interference such as radio or TV stations, cellular phone or mobile two-way radios.

WARNING

Interaction Between Minute Ventilation Rate-Adaptive Pacemakers and Cardiac Monitoring and Diagnostic Equipment*

The bioelectric impedance measurement sensor of a minute ventilation rate-adaptive implantable pacemaker may be affected by cardiac monitoring and diagnostic equipment which is connected to the same patient. If this occurs, the pacemaker may pace at its maximum rate and give incorrect data to the monitor or diagnostic equipment. If this occurs, disconnect the monitor or diagnostic equipment from the patient or change the setting on the pacemaker by referring to the pacemaker's manual. For more details, contact your pacemaker distributor or Nihon Kohden distributor.

* Minute ventilation is sensed in rate-adaptive pacemakers by a technology known as bioelectric impedance measurement (BIM). Many medical devices in addition to pacemakers use this technology. When one of these devices is used on a patient with an active, minute ventilation rate-adaptive pacemaker, the pacemaker may erroneously interpret the mixture of BIM signals created in the patient, resulting in an elevated pacing rate.

For more information, see the FDA web site.
http://www.fda.gov/cdrh/safety.html

Conventions Used in this Manual and Instrument

Warnings, Cautions and Notes

Warnings, cautions and notes are used in this manual to alert or signal the reader to specific information.

WARNING

A warning alerts the user to possible injury or death associated with the use or misuse of the instrument.

CAUTION

A caution alerts the user to possible injury or problems with the instrument associated with its use or misuse such as instrument malfunction, instrument failure, damage to the instrument, or damage to other property.

NOTE

A note provides specific information, in the form of recommendations, prerequirements, alternative methods or supplemental information.

Explanations of the Symbols in this Manual and Instrument

The following symbols found in this manual/instrument bear the respective descriptions as given.

On panels

Symbol	Description	Symbol	Description
	Monitor power on		Home (monitoring screen)
	Monitor power off		Setting screen
	AC operation (front panel) Alternating current (rear panel)		Record start/stop (for optional recorder unit)
	Battery operation		Defibrillation-proof type CF applied part
	Battery charging		Defibrillation-proof type BF applied part
	Alarm silence		Attention, consult operator’s manual
	NIBP		ZB-900PK transmitter socket
	NIBP interval		Output terminal
	NIBP start		Equipotential terminal
	NIBP stop		Year of manufacture
	Review		Serial number

On screen

Symbol	Description	Symbol	Description
	Alarm silence with remaining minutes		Body movement (SpO_2)
	Alarm off		Recording
	QRS/pulse sync mark		Recorder door open (when using optional recorder unit)
	Respiration sync mark		Out of paper (when using optional recorder unit)
	NIBP measurement on neonate		Transmitter connected to the monitor

Others

Symbol	Description	Symbol	Description
	Recycle (On battery pack)	IPX4	Splash-proof equipment (On transmitter)

Section 1 General

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Section 1 provides a general overview of the equipment and how to operate it. If you have not used an OPV-1500K bedside monitor before, read this section first.

- Features
- Components in the system
- Panel descriptions
- Screen displays
- Basic operation concepts
- Important safety information

Introduction

The Life Scope N OPV-1500K hardwire bedside monitor can monitor ECG, impedance method respiration, SpO_2 and NIBP. Its easy operation and compact lightweight design lets you use this bedside monitor in the general ward, examination room, dialysis room, treatment room and for patient transport. For portability, it can operate on battery power as well as AC power.

NOTE

Use only Nihon Kohden parts and accessories to assure maximum performance from your instrument.

Features

- **Hardwire system**
  Monitors ECG, impedance method respiration, SpO_2 and NIBP.

- **AC or battery (option) operation**
  The monitor can operate on AC power or battery for up to 1 hour.

- **Color data display**
  Detailed information is displayed on the wide angle, 5.6 inch color LCD. Monitoring parameters are automatically identified.

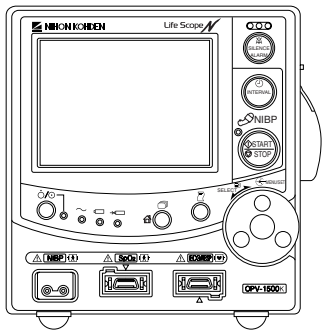
- **Easy operation by the hard keys and rotary dial**
  The monitor can be easily operated using the hard keys and rotary dial on the panel.

- **Review windows for viewing saved data**
  Saved data can be displayed on the trendgraph window and list window.

- **Thermal array recorder with 60 mm width paper (option)**
  Waveforms, numeric data, trendgraphs, and vital signs lists can be recorded manually or automatically on the optional RG-101W recorder unit. Up to two channels can be recorded.

- **Telemetry system (option)**
  When the optional ZB-900PK transmitter is connected to the bedside monitor, waveform(s) and parameter data from the bedside monitor can be sent to a Cardiac Telemetry System or to a Central Monitor via a Multiple Patient Receiver and recorded. (Available waveforms and parameter data depend on the receiving monitor.)

Composition



Life Scope N Bedside Monitor
OPV-1500K

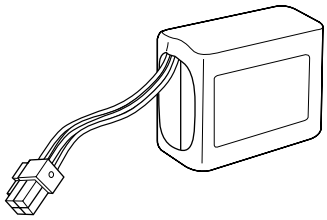
Options

Accessory Kit, YZ-023H5/YZ-023H6/YZ-023H7/YZ-023H8 (option)

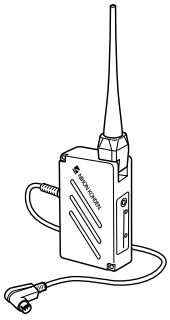
Cart, KC-012P (option)

Recorder Unit, RG-101W (option)

Alarm Pole, YL-001P (option)



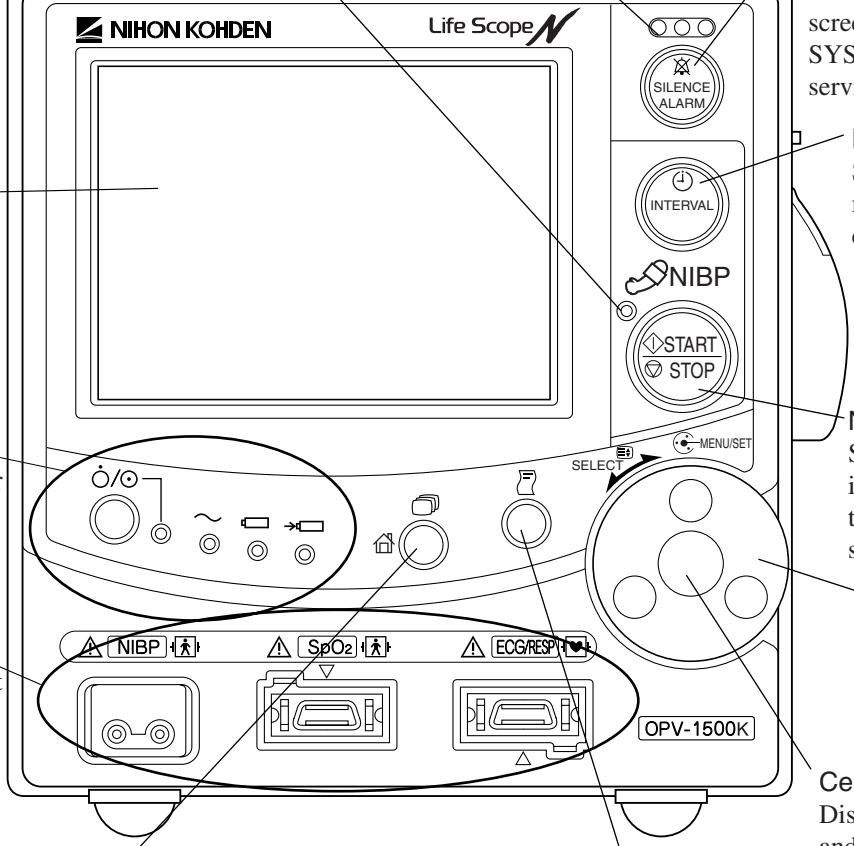
Battery Pack, NKB-302 (option)



Transmitter, ZB-900PK (option)

Panel Description

Front Panel



Alarm indicator
Red or yellow lamp blinks or lights according to the alarm settings.

NIBP lamp
Lights during NIBP measurement.

SILENCE ALARM key
Silences the alarm sound.
When the power key is pressed while this key is pressed, the MAINTENANCE MODE screen is displayed for the SYSTEM SETUP settings and servicing.

NIBP INTERVAL key
Selects NIBP measurement mode. Pressing this key changes the mode.

Screen
Displays monitoring data.

NIBP START/STOP key
Starts NIBP measurement in selected mode. Pressing this key during measurement stops measurement.

Power panel
Refer to the "Power Panel" section.

Rotary dial
Selects item on the setup windows.
Scrolls data on the review windows.

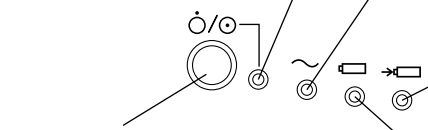
Socket panel
Refer to the "Socket Panel" section.

Center key
Displays the setup windows and registers the setting.

Screen select key
Changes the screen in the following order:
Monitoring screen, list window, trend window, sleep mode screen.
Displays monitoring screen when pressed on the setup window.

Record key
Press to start or stop recording.

Power Panel



Power lamp
Lights when the monitor is turned on.

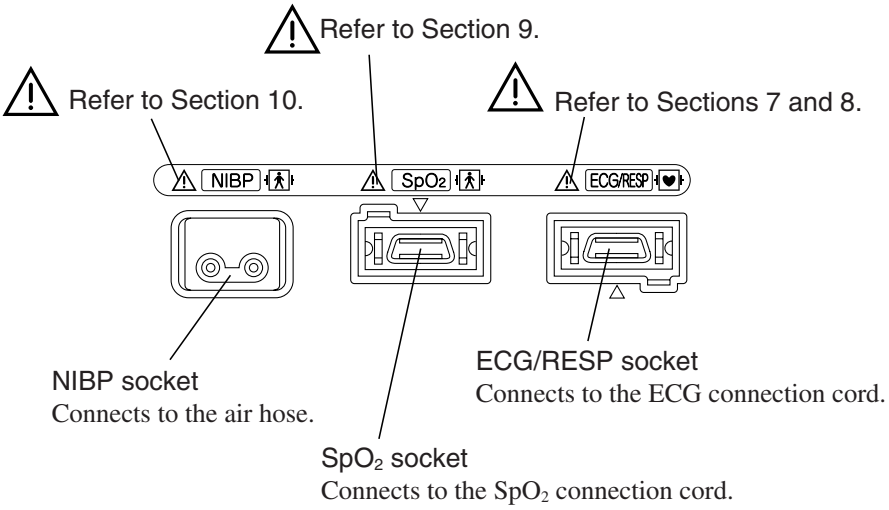
AC power lamp
Lights when the power cord is connected between the AC SOURCE socket and AC outlet.

Battery charging lamp
Indicates the battery status.
Lit: Fully charged
Blinking: Being charged

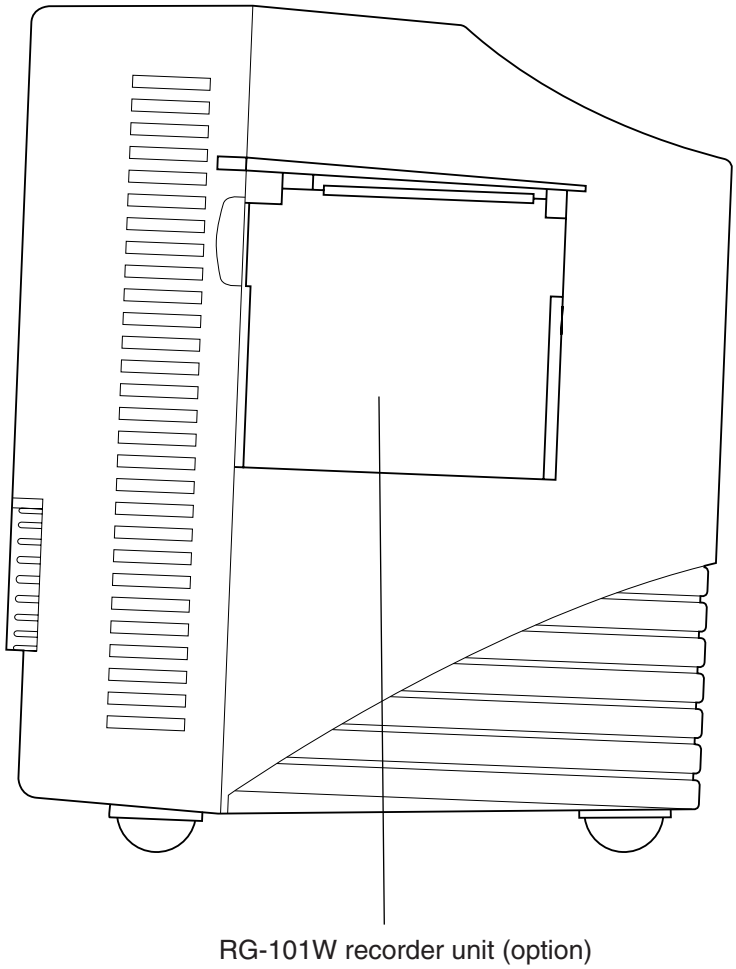
Power key
Press and hold for more than one second to turn the monitor on or off.

Battery power lamp
Lights when operating on battery power.

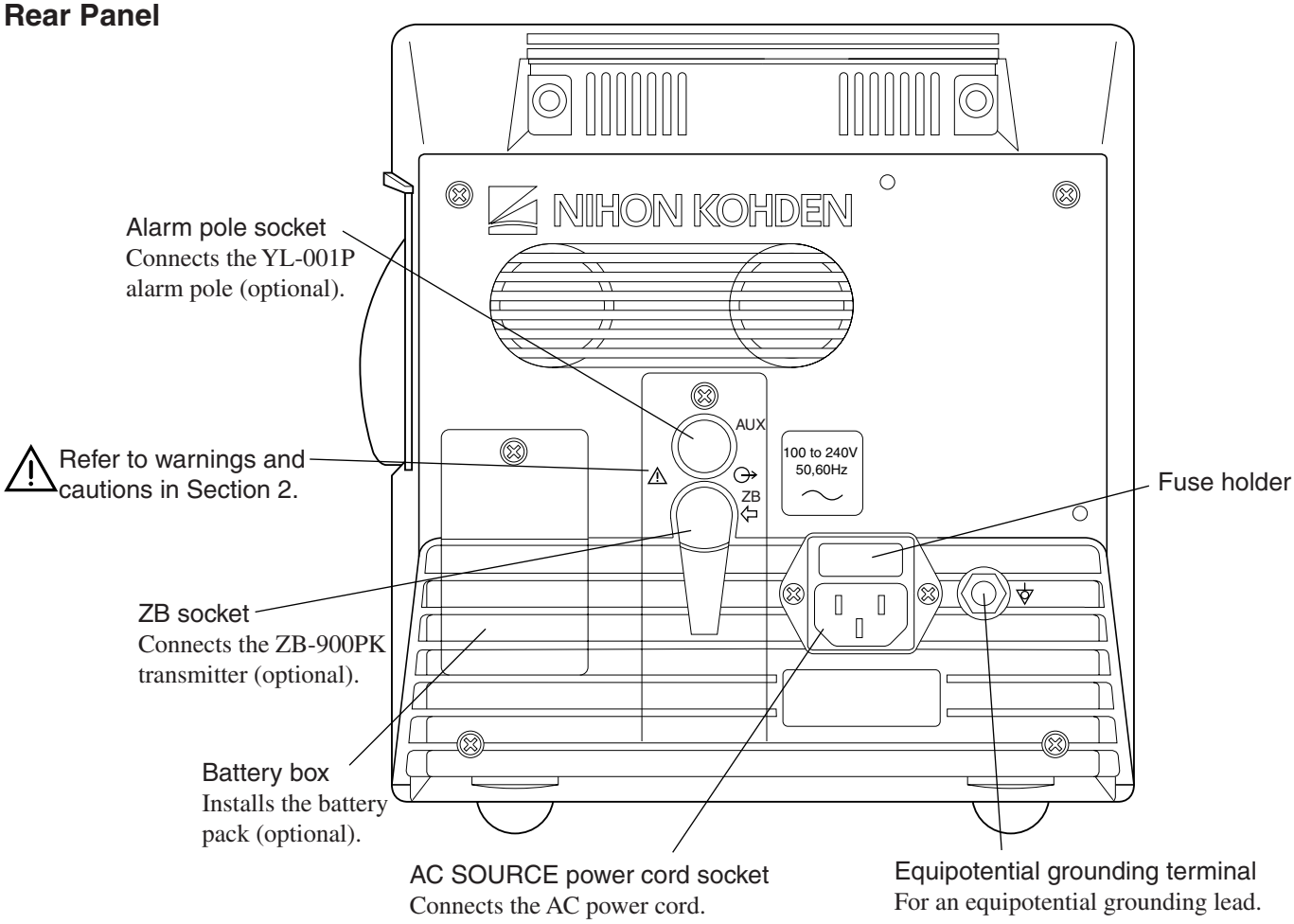
Socket Panel



Right Side Panel



Rear Panel


NIHON KOHDEN
AUX
100 to 240V
50,60Hz
ZB
Alarm pole socket
Connects the YL-001P alarm pole (optional).
Refer to warnings and cautions in Section 2.
Fuse holder
ZB socket
Connects the ZB-900PK transmitter (optional).
Battery box
Installs the battery pack (optional).
AC SOURCE power cord socket
Connects the AC power cord.
Equipotential grounding terminal
For an equipotential grounding lead.

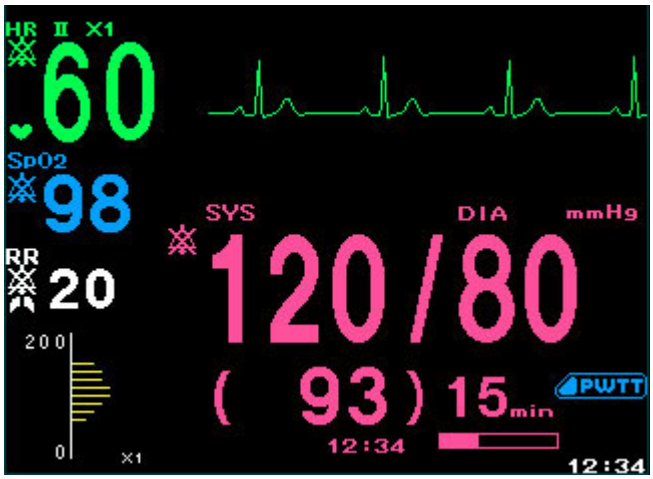
Basic Operating Concepts

Screen Displays

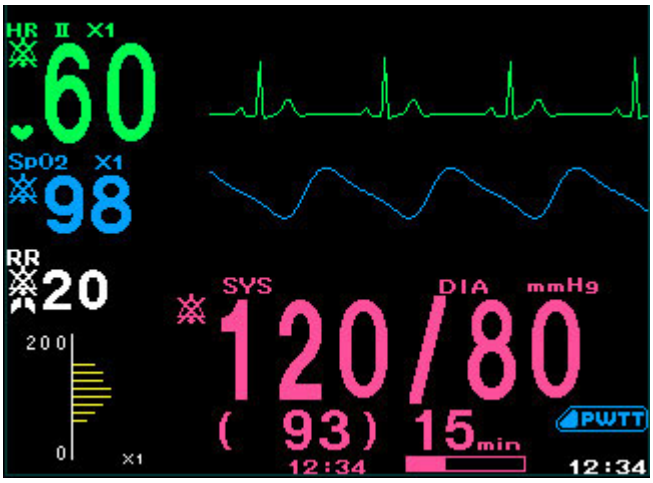
Following are the screens and windows available on the Life Scope N bedside monitor. For details about the individual screens and windows, see the appropriate section.

The shadow of the previous screen may remain for a few minutes after changing the screen.

Monitoring screen

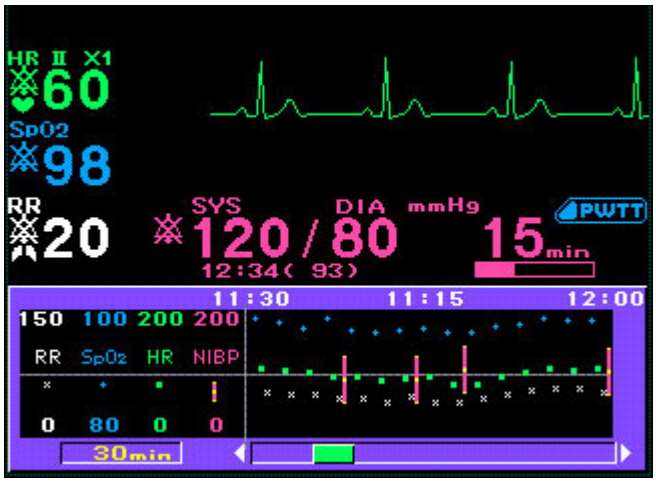


One waveform display

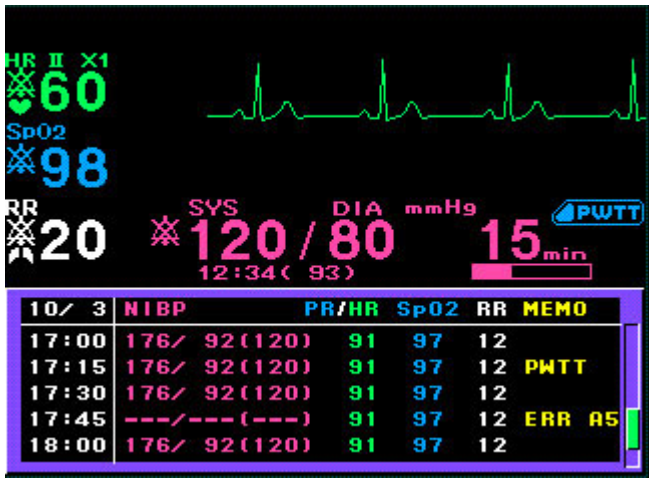


Two waveform display

Review windows

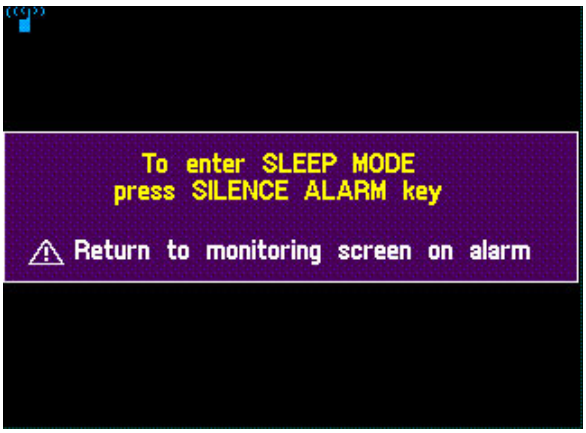


Trendgraph window for displaying 24 hour trendgraph



List window for displaying list of parameter data

Sleep mode screen

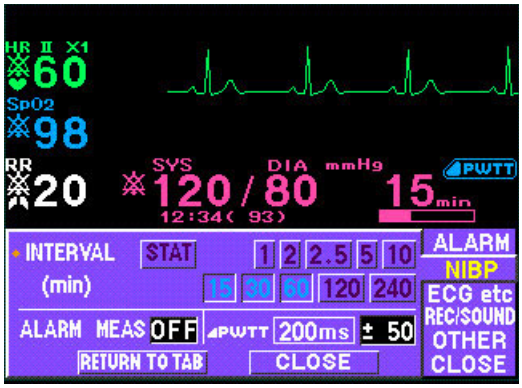


Sleep mode confirmation screen

Sleep mode screen

Setup windows

ALARM setting window



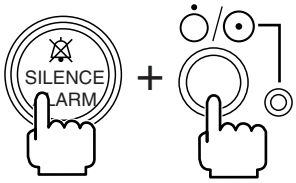
NIBP setting window

ECG etc window for changing parameter settings other than NIBP

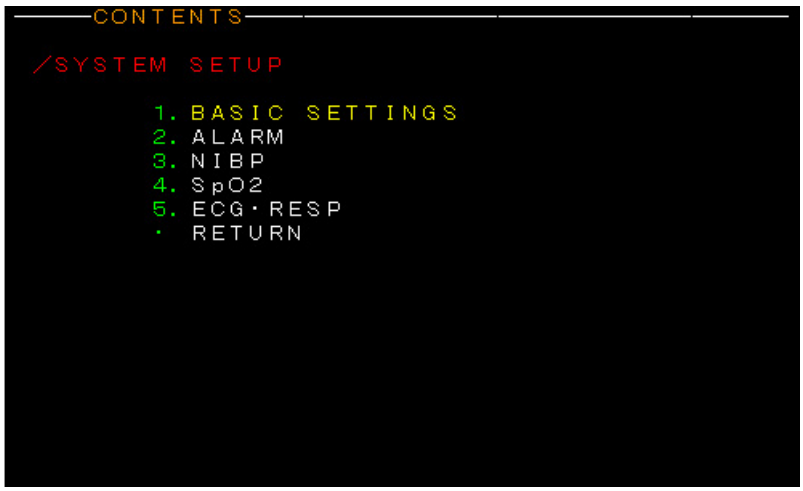
REC/SOUND window for setting recording and sound settings

OTHER window for setting waveform display, list interval, date and time and deleting saved data

SYSTEM SETUP screen



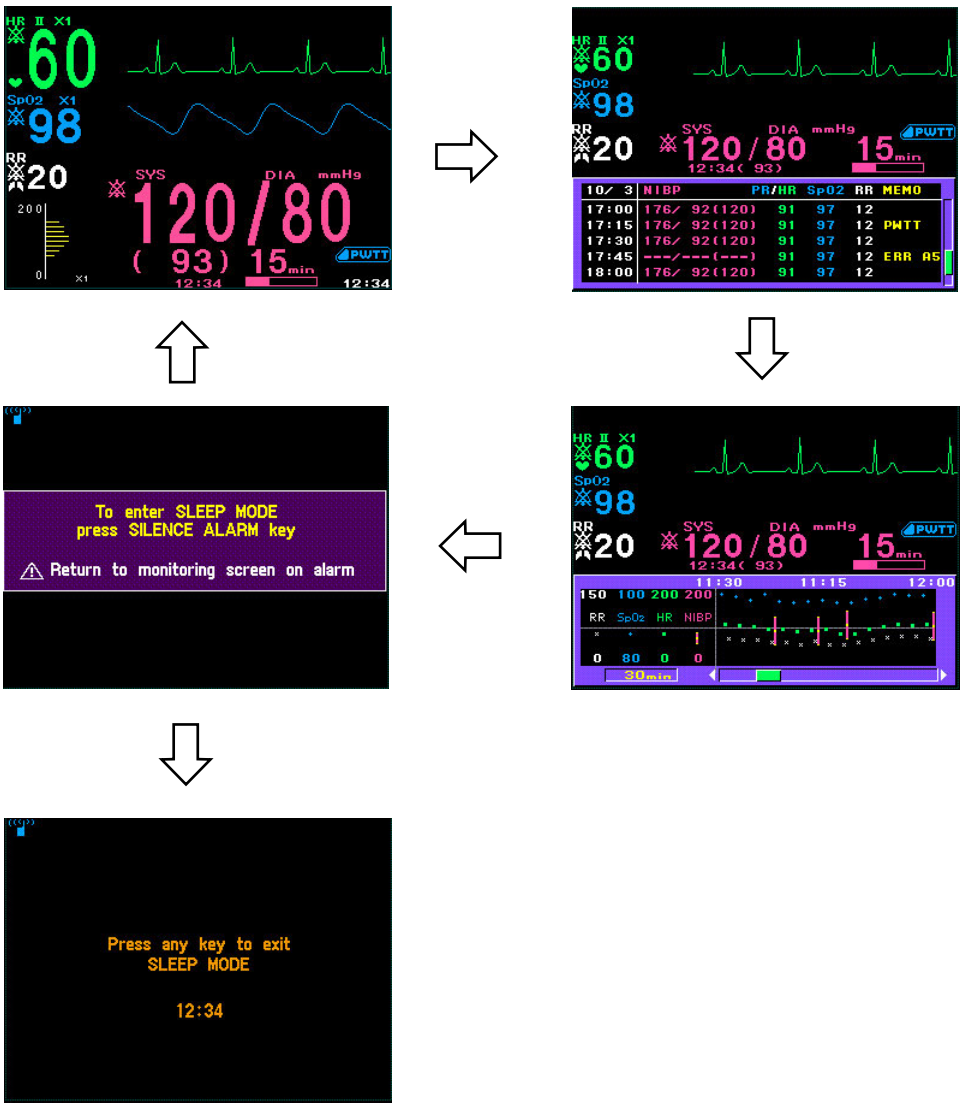
For changing system settings. Displaying the SYSTEM SETUP screen interrupts monitoring.



Displaying Monitoring Screen and Review Windows

Pressing the HOME/REVIEW key on the front panel changes the screen in the following order.

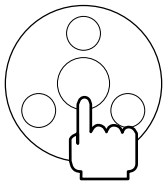
Monitoring → list window → trendgraph window → sleep mode confirmation screen→ monitoring



Pressing the SILENCE ALARM key on the sleep mode confirmation screen enters sleep mode

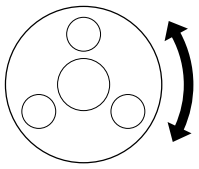
Displaying Setup Windows

From the monitoring screen, press the rotary dial center key on the front panel. The ALARM window is displayed. Turning the rotary dial changes the setup window in the following order.

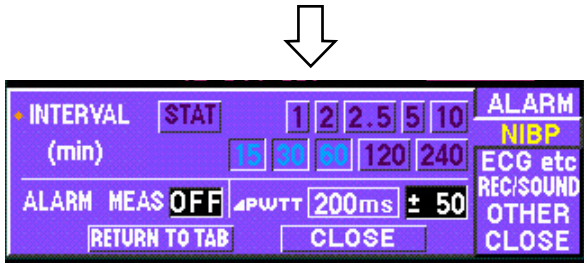


Press the rotary dial center key on the monitoring screen

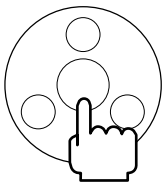
ALARM window



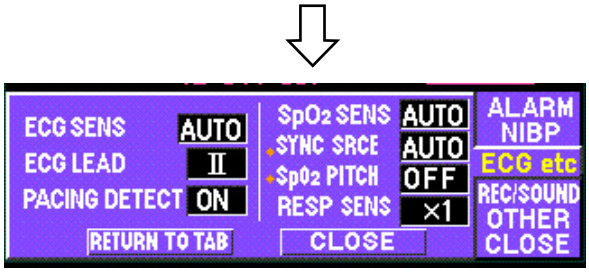
Turn the rotary dial to change the setup window



NIBP window



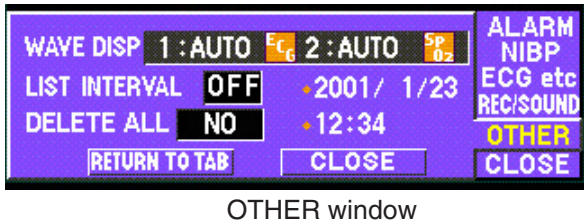
Press the rotary dial center key on the setup window to enter the window



ECG etc window

REC/SOUND window

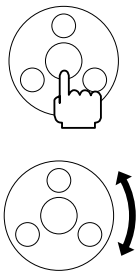
The red diamond mark in front of the setting item indicates that this setting returns to the factory default setting 30 minutes after monitor power off.



OTHER window

CLOSE window for closing the setup windows

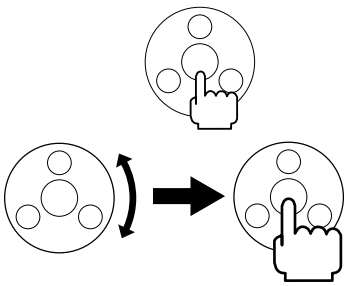
Changing a Setting



For example, to change the ECG lead:

1. Display the ECG etc window.
   a) From the monitoring screen, press the rotary dial center key. The ALARM window opens.

   b) Turn the rotary dial to select “ECG etc” tab.



2. Press the rotary dial center key to enter the ECG etc window. The cursor moves to the “ECG SENS” box.

3. Turn the rotary dial to move the cursor to “ECG LEAD” and press the rotary dial center key to change the cursor color to blue.

4. Turn the rotary dial to select the lead and press the rotary dial center key to register the setting.

5. To change other items on the same window, repeat steps 3 and 4.

   To change settings on other windows, move the cursor to “RETURN TO TAB” and press the rotary dial center key. The cursor moves to tab.

   To close the setup window, select “CLOSE” on the setup window and press the rotary dial center key,

   or select “CLOSE” on the setup window tab and press the rotary dial center key,

   or press the HOME/REVIEW key on the front panel.

General Safety Information

General

WARNING

- **Never use this monitor in the presence of any flammable anesthetic gas, concentrated oxygen or hyperbaric oxygen. Failure to follow this warning may result in explosion.**
- **Never use the monitor in a high-pressure oxygen medical care tank. Failure to follow this warning may cause explosion or fire.**
- **When using this monitor with an electrosurgery unit, its return plate and the electrodes for monitoring must be firmly attached to the patient. If the return plate is not attached correctly, it may burn the patient's skin where the electrodes are attached. Refer to the instruction manual for the ESU.**
- **When performing MRI tests, remove the electrodes and transducers connected to the monitor from the patient. The heat generated from the induced electromotive force may burn the patient's skin. For details, refer to the instruction manual for the MRI.**
- **When performing defibrillation, discharge as far as possible from electrodes and medicine on the chest of the patient. If there is a possibility that the defibrillator paddle could touch electrodes and medicine, remove electrodes and medicine from the patient. If the defibrillator directly contacts these materials, the discharged energy may cause serious electrical burn to the patient.**
- **Before performing defibrillation, check that the cords and cables of the electrodes and transducers attached to the patient are properly connected to the monitor. Touching the metal parts of disconnected cords and cables may cause serious electrical shock or injury by discharged energy.**
- **To avoid the risk of serious electrical burn, shock or other injury during defibrillation, all persons must keep clear of the bed and must not touch the patient or any equipment connected to the patient.**
- **During alarm suspension, all current alarms are temporarily turned off.**
- **When EXIT SLEEP MODE ON ALARM on the SYSTEM SETUP screen is set to NO, the bedside monitor alarm cannot be seen or heard on the bedside monitor during sleep mode. Attach the transmitter (option) to the monitor and monitor the bedside monitor alarm on the central monitor or telemetry system. Otherwise, bedside monitor alarms may be overlooked.**

CAUTION

- **Use only Nihon Kohden specified electrodes, probes and cuffs. Otherwise, the maximum performance from the monitor cannot be guaranteed.**
- **Do not reuse disposable parts.**

- **Turn off the power of cell telephones, small wireless devices and other devices which produce strong electromagnetic interference. Otherwise, the waveforms and measurements are affected by such interference and the displayed data may be incorrect.**
- **Before monitoring a new patient, first delete all data of the previous patient. Otherwise, the data of the previous patient and new patient will be mixed together.**
- **Alarm recording is not performed when alarm is suspended or alarm recording is set to off.**
- **When the alarm limit is turned off, there will be no alarm for that parameter limit.**
- **When the "ECG CONNECTOR OFF", "SpO2 CONNECTOR OFF" or "AIR HOSE OFF" message appears on the screen, check that the connection cords are connected to the sockets properly. Patient cannot be monitored and the alarm does not function properly while this message is displayed.**
- **If fluids are accidentally spilled on the monitor, take the bedside monitor out of service and check for damage.**

Installation

WARNING

- **For patient safety, equipotential grounding of all instruments must be performed. Consult with a qualified biomedical engineer.**
- **Only use the provided power cord. Using other power cords may result in electrical shock or other injury to the patient and operator.**
- **When the provided power cord cannot be used or when equipotential grounding is doubtful (such as in poor grounding facility), operate the monitor on battery power.**
- **Connect only the specified instrument to the socket marked with ⚠ by following the specified procedure. Otherwise, electrical leakage current may harm the patient and operator.**

CAUTION

- **When connecting the monitor to other instruments, the connection must comply with IEC60601-1-1. Refer to "General Requirements for Connecting Medical Electrical System" in Section 13.**
- **Disconnect the power cord of all instruments from the AC SOURCE socket before connecting the instruments. Otherwise there may be an electrical shock.**
- **Avoid locations where the monitor and system may be sprinkled with water or chemical solutions. Otherwise the monitor and system may be damaged.**
- **When not using the KC-012P cart, make sure that the monitor is**

placed and fastened so that it does not tip over.

- **Install the monitor and ESU appropriately and perform equipotential grounding. Otherwise, noise from the ESU may interfere with the ECG and ECG monitoring may not be performed properly.**
- **When the monitor power is turned on, check that one "bong" sounds and the red and orange alarm indicators blink once to show that the alarm functions properly.**

Also read the warning and caution in "Selecting a Suitable Location" in Section 2.

Using KC-012P Cart

CAUTION

- **Use only the KC-012P cart for the OPV-1500K bedside monitor. If another cart is used, it may tip over or the monitor may fall off.**
- **When the monitor is mounted on the cart, confirm that the lever on the holder completely springs up. If the monitor is not locked, it may fall off.**

Using ZB-900PK Transmitter

CAUTION

Heart rate may differ between the monitor and the telemetry system or central monitor due to the difference on the displaying ECG waveform.

Using YL-001P Alarm Pole

CAUTION

- **Firmly connect the alarm pole connector to the alarm pole socket on the monitor. Otherwise, the lamp may not blink and an alarm may not be indicated.**
- **Do not carry the monitor by holding the alarm pole. The alarm pole may detach from the monitor and the monitor may fall off.**

Battery

WARNING

- **Keep the battery pack away from fire. Otherwise the battery pack may explode.**
- **Do not heat the battery pack. The battery pack may explode.**
- **Never short-circuit the + and – terminals on the battery pack with a wire or store the battery pack with metals such as necklace or hair pins. The battery pack may short-circuit, causing the substance inside the battery to leak or explode.**
- **Never disassemble or modify the battery pack. Never damage or directly solder the sheath tube. The battery pack short-circuits, the electrolyte comes out and the battery pack explodes.**
- **Do not subject the battery pack to a strong mechanical shock. The battery may leak or explode.**
- **Do not use a battery which is damaged, such as from falling. There is a gas discharge valve inside the battery and if this valve is damaged, the gas cannot be discharged, causing the battery to explode.**
- **Only use the battery pack on the specified instrument. If the battery is used on an unspecified instrument, large current may flow, causing the battery to explode.**
- **If the battery pack is damaged and the substance inside the battery (alkaline liquid) contacts the eyes or skin, wash immediately and thoroughly with water and see your physician. Never rub your eyes, otherwise you may lose your eyesight.**
- **The battery pack has + and – polarity. Make sure that the battery is installed with the correct polarity direction. Otherwise, the substance inside the battery may leak and explode.**
- **Do not connect the battery pack to an AC outlet or lighter socket in a car. The battery may explode.**
- **Do not immerse the battery pack in water or seawater. The battery will rust and may heat up.**
- **Never use a battery pack which is damaged, discolored or has leakage. A damaged battery may explode if used.**
- **Do not leave the battery for more than two years unused. The battery may leak.**

CAUTION

- **Do not expose the battery pack to direct sunlight or leave in a high temperature place. The lifetime of the battery pack may be shortened or the substance inside the battery pack may leak.**
- **The battery pack must be replaced by qualified service personnel.**
- **Keep the battery pack away from children.**
- **Before disposing of the battery, check with your local solid waste officials for details in your area for recycling options or proper disposal. The battery is recyclable. At the end of its useful life, under various state and local laws, it may be illegal to dispose of this**

battery into the municipal waste stream.

ECG Monitoring

WARNING

Interaction Between Minute Ventilation Rate-Adaptive Pacemakers and Cardiac Monitoring and Diagnostic Equipment*

The bioelectric impedance measurement sensor of a minute ventilation rate-adaptive implantable pacemaker may be affected by cardiac monitoring and diagnostic equipment which is connected to the same patient. If this occurs, the pacemaker may pace at its maximum rate and give incorrect data to the monitor or diagnostic equipment. If this occurs, disconnect the monitor or diagnostic equipment from the patient or change the setting on the pacemaker by referring to the pacemaker's manual. For more details, contact your pacemaker distributor or Nihon Kohden distributor.

* Minute ventilation is sensed in rate-adaptive pacemakers by a technology known as bioelectric impedance measurement (BIM). Many medical devices in addition to pacemakers use this technology. When one of these devices is used on a patient with an active, minute ventilation rate-adaptive pacemaker, the pacemaker may erroneously interpret the mixture of BIM signals created in the patient, resulting in an elevated pacing rate.
For more information, see the FDA web site.
http://www.fda.gov/cdrh/safety.html

WARNING

- **When using a defibrillator together with the monitor, use Ag/AgCl electrodes. Other types of electrodes, stainless steel in particular, adversely affect the ECG waveform by slowing the baseline recovery on the monitor and result in no monitoring immediately following defibrillation.**
- **False heart rate indicators may occur with certain pacemakers because of electrical overshoots.**
- **Pacemaker patients can only be monitored when the pace program is activated.**
- **Keep pacemaker patients under close observation. The pacemaker rate may be counted during cardiac arrest and certain arrhythmias. Do not rely only on the monitor.**

CAUTION

- **Use only Nihon Kohden products and specified parts and accessories. When other type of electrodes are used, the "CHECK ELECTRODE" message may be displayed and monitoring may stop.**
- **Do not reuse disposable electrodes.**
- **When using the electrodes with DIN type lead, use only the Vitrode V or N electrodes. If other electrodes are used, the electrode lead may not be properly connected and ECG monitoring may be unstable.**
- **If the contact is bad even before the expiration date printed on the package, replace the electrode with a new one.**
- **When the "CHECK ELECTRODE" message is displayed, ECG is not monitored properly. Check the electrode, electrode leads and connection cord, and if necessary, replace it with a new one.**
- **When using the monitor with an ESU, locate the monitor and ESU following the description in "Use with an Electrosurgical Unit" in Section 7 and ground the instruments properly. Otherwise noise from the ESU may interfere with the ECG and the heart rate and arrhythmia analysis may be incorrect.**
- **Turn the pacing spike detection to On when monitoring a pacemaker patient. Otherwise QRS and pacemaker spike may not be distinguished and pacemaker failure may not be recognized.**

Respiration Monitoring

WARNING

Interaction Between Minute Ventilation Rate-Adaptive Pacemakers and Cardiac Monitoring and Diagnostic Equipment*

The bioelectric impedance measurement sensor of a minute ventilation rate-adaptive implantable pacemaker may be affected by cardiac monitoring and diagnostic equipment which is connected to the same patient. If this occurs, the pacemaker may pace at its maximum rate and give incorrect data to the monitor or diagnostic equipment. If this occurs, disconnect the monitor or diagnostic equipment from the patient or change the setting on the pacemaker by referring to the pacemaker's manual. For more details, contact your pacemaker distributor or Nihon Kohden distributor.

* Minute ventilation is sensed in rate-adaptive pacemakers by a technology known as bioelectric impedance measurement (BIM). Many medical devices in addition to pacemakers use this technology. When one of these devices is used on a patient with an active, minute ventilation rate-adaptive pacemaker, the pacemaker may erroneously interpret the mixture of BIM signals created in the patient, resulting in an elevated pacing rate.
For more information, see the FDA web site.
http://www.fda.gov/cdrh/safety.html

WARNING

When using an ESU, set RESP SENS to OFF. The noise from ESU is superimposed on the waveform and the respiration measurement cannot be monitored accurately.

SpO_2 Monitoring

WARNING

- **Measurement may not be correct in the following cases.**
  - **When the oxyhemoglobin or methemoglobin (HbCO, Met Hb) increases abnormally.**
  - **When dye is injected in the blood.**
  - **When using an electrosurgical unit.**
  - **During CPR.**
  - **When there is body movement.**
  - **When the pulse wave is small.**
- **Check the circulation condition by observing the skin color of the measuring site and pulse waveform. Change the measuring site every 8 hours for disposable probes and every 4 hours for reusable probes. The skin temperature may increase at the attached site by 2 or 3°C (4 or 5°F) and cause a burn or pressure necrosis. When using the probe on the following patients, take extreme care and change the measurement site more frequently according to symptoms and degree.**
  - **A patient with a fever**
  - **A patient with peripheral circulation insufficiency**
  - **Neonate or low birth weight infant with delicate skin**
- **To avoid poor circulation, do not wrap the tape too tight. Check the blood circulation condition by observing the skin color and congestion at the skin peripheral to the probe attachment site. Even for short-term monitoring, there may be burn or pressure necrosis from poor blood circulation, especially on neonates or low birth weight infants whose skin is delicate. Accurate measurement cannot be performed on a site with poor peripheral circulation.**
- **When not monitoring SpO_2, disconnect the SpO_2 connection cord from the bedside monitor. Otherwise, noise from the probe sensor may interfere and incorrect data is displayed on the screen.**
- **Do not use the probe during MRI examination because it may cause skinburn on the probe attachment area. For details, follow the MRI operator's manual.**

CAUTION

- **Turn off the power of cell telephones, small wireless devices and other devices which produce strong electromagnetic interference.**

Otherwise, the waveforms and measurements are affected by such interference and the displayed data may be incorrect.

- **Only use the specified probes. Otherwise SpO_2 cannot be monitored properly.**
- **Do not use a disassembled or damaged probe because measured data may be incorrect.**
- **Do not use the probe over its stated lifetime. Otherwise the SpO_2 measurement accuracy cannot be guaranteed.**
- **If the skin gets irritated by the tape, change the attachment site.**
- **Do not attach the probe to the same limb that is used for NIBP measurement or an IBP catheter.**
- **Normally external light does not affect monitoring, however, strong light such as an operating lamp or sunlight may affect monitoring. If affected, cover the measuring site with a blanket.**
- **When attached, make sure that the photo emitter and the detector of the probe face each other. Otherwise, SpO_2 cannot be measured properly.**
- **Do not reuse the disposable probes for another patient.**
- **Disposable probes are not sterilized. To sterilize the probe, refer to the "Sterilizing the Disposable Probe" in Section 12.**
- **When the probe is attached on an appropriate site with sufficient circulation and the error message confirming the probe attachment repeatedly appears, the probe may be deteriorated. Replace it with a new one.**
- **When the probe or SpO_2 connection cord failure message appears on the screen, replace it with a new one. Otherwise SpO_2 data may not be accurate.**
- **When the attachment site is wet with blood or when the patient has nail polish on, remove dirt and nail polish before attaching the probe. The transmitted light may decrease due to blood or nail polish and the measurement data may be incorrect.**
- **To minimize body movement for stable SpO_2 monitoring, fasten the cable with the provided adhesive tape.**
- **Do not pull or bend the probe cable, and do not put caster feet on the probe cable. Do not immerse the probe cable in detergents or water. Failure to follow these cautions may cause cable discontinuity, short circuit, skin burn on the patient and incorrect measurement data. Replace any broken probe with a new one.**
- **When using a disposable probe, be careful when removing the foam tape from neonatal skin.**
- **When removing a disposable probe that is taped to the skin, do not pull the cable part of the probe because this can damage the probe's cable connection.**
- **Refer to the probe instruction manual for details.**

NIBP Monitoring

WARNING

- **NIBP measurement on a sickle cell anemia patient may cause a thrombus.**
- **When attaching the cuff to a premature infant at an early stage after birth, periodically change the cuff position to avoid possible skin erosion and fissure.**
- **While performing STAT (continuous) measurements many times without a pause, periodically check the blood vessels and limb for adequate circulation.**
- **When performing long term measurements at intervals less than 2.5 minutes, periodically check the state of the patient, blood vessels and limb for adequate circulation.**

CAUTION

- **Only use the specified cuff. Otherwise NIBP monitoring cannot be performed properly or the monitor may be damaged.**
- **Select the cuff which fits each patient. If the cuff size is not correct, measurement may not be completed or the result may be erroneous due to the different deflation speed of the cuff.**
- **The YP-950T/951T/952T/953T/954T/955T reusable cuffs contain natural rubber latex which may cause allergic reactions.**
- **Do not reuse the disposable cuff.**
- **Disposable cuffs are not sterilized. If necessary, sterilize the cuff using glutaraldehyde solution.**
- **The non-sterilized disposable cuffs for neonates cannot be sterilized. If necessary, use the sterilized disposable cuffs for neonates.**
- **Never sterilize the disposable cuff for neonates.**
- **Do not wrap the cuff on an arm or thigh which is used for injection. NIBP measurement on an arm or thigh which is used for injection may cause reflux of blood and stop injection.**
- **Confirm that the air hoses are firmly connected between the sockets and hoses of the cuff. If not connected properly (the air hose connector clicks and the red color of the NIBP socket is completely hidden behind the air hose connector when properly inserted into the socket), the cuff cannot be correctly identified and air leakage will cause incorrect NIBP data or no data.**
- **When too much pressure is applied to the cuff, or the hose is folded or kinked, the "NIBP SAFETY VALVE OPEN" message appears on the screen and NIBP monitoring may be stopped. Remove the cause, wait for 40 seconds, check that the message disappears, then measure again.**
- **If the hose is folded or squeezed, it will cause incorrect NIBP data due to the air pressure noise.**
- **Do not rely only on the PWTT to monitor blood pressure changes. When it is necessary to monitor critical blood pressure change, set the appropriate interval for NIBP measurement.**

- **When the delta PWTT threshold is too short for a patient, NIBP measurement may be performed too frequently. If this occurs, change the delta PWTT threshold to a longer time.**
- **The PWTT may be incorrect when there is too much arrhythmia or noise.**
- **In the following cases, PWTT may trigger too many or no NIBP measurements. Check the patient condition. If necessary, change the delta PWTT threshold or set PWTT to Off.**
  - **Rapid blood pressure change with vasoreflex due to vasoactive drugs, such as phenylephrine and nicardipine.**
  - **Unstable pulse wave due to poor peripheral circulation.**
  - **Too many arrhythmias.**
  - **Patient movement.**
  - **Noise on ECG due to ESU.**
  - **SpO_2 measurement on foot of a child.**
- **Do not measure NIBP with PWTT on a neonate because circulation of a neonate changes rapidly.**

Maintenance

CAUTION

- **Do not disassemble the monitor. Disassembly must be performed by a qualified service personnel.**
- **Fuses must be replaced by a qualified service personnel.**
- **Do not use volatile liquids such as thinner or benzine, because these will cause the materials to melt or crack.**
- **Before cleaning the monitor, turn the monitor power off and disconnect the power cord from the AC SOURCE power cord socket on the right side panel.**
- **After cleaning, make sure that the monitor is completely dried.**
- **Wipe the monitor thoroughly after disinfecting it with spray.**
- **The bedside monitor is not waterproof. Be careful not to let any water get inside the monitor.**
- **Never sterilize the monitor because the materials may deform, crack or discolor.**

Section 2 Preparations

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Preparation Flowchart

You may not need to do all these.

1. Install the monitor and do the procedures in Section 2.

2. Delete data of the previous patient. Refer to the “Deleting Data” section.

3. Check or change any initial settings on the SYSTEM SETUP screen. These items usually do not need to be changed. Refer to Section 3.

4. Check or change all alarm items for the patient. Refer to Section 4.

5. Check or change settings for the vital signs list and trendgraphs. Refer to Section 5.

6. Check or change recording settings. Refer to Section 6.

7. Prepare the equipment (electrodes, probes, cuffs, etc.) for monitoring individual parameters and check or change the settings for each parameter. Refer to Sections 7 to 10.

Installation Conditions

Put the monitor on a stable and flat stand or on an optional KC-012P cart in a suitable location where the screen is easy to see and does not reflect light. Follow the cautions below.

For installing the monitor on the KC-012P cart, refer to the KC-012P cart installation guide.

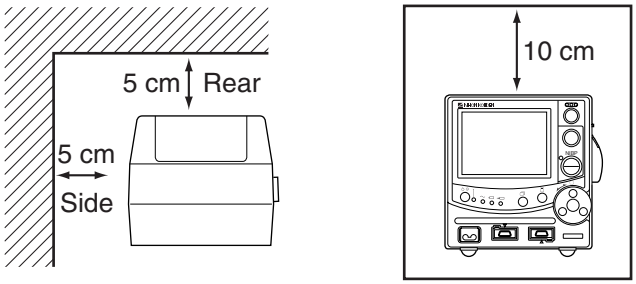
WARNING

- **Never use this monitor in the presence of any flammable anesthetic gas, concentrated oxygen or hyperbaric oxygen. Failure to follow this warning may result in explosion.**
- **Connect only the specified instruments to the connector or sockets marked with ⚠ by following the specified procedure. Otherwise, electrical leakage current may harm the patient and operator.**

CAUTION

- **Avoid collision when moving the monitor on a cart. Strong impact may damage the monitor.**
- **The display screen is made of glass. Strong impact may damage it.**
- **Avoid a location where the monitor is sprinkled with liquids. Avoid direct sprinkling, spray or moist air from a nebulizer or a humidifier.**
- **If fluids are accidentally spilled on the monitor, take the monitor out of service and check for damage.**
- **Avoid locations where the monitor may receive strong electromagnetic interference such as radio or TV stations, cell phones or mobile two-way radios.**
- **Do not use the monitor in an ambulance. The monitor may not function properly in a moving vehicle.**
- **Avoid exposing the monitor to direct sunlight. The monitor life may be shortened or the monitor may get damaged.**
- **Do not place the monitor in a dusty area.**
- **Do not place blankets or cloth over the monitor. It may affect monitoring.**
- **Connect the power cord to an AC outlet which can supply enough AC current to the monitor. The monitor cannot function properly with low current.**
- **Do not place the monitor in an MRI examination room. The monitor may not function properly, or noise from the monitor may interfere with the MRI.**

- **Do not use an electrical blanket. It may affect monitoring.**
- **Make sure that there is more than 5 cm of space between the monitor and the wall for adequate ventilation. When the monitor is surrounded, make sure that there is about 10 cm of space above the monitor for ventilation so that the operating temperature does not exceed 40°C (104°F).**

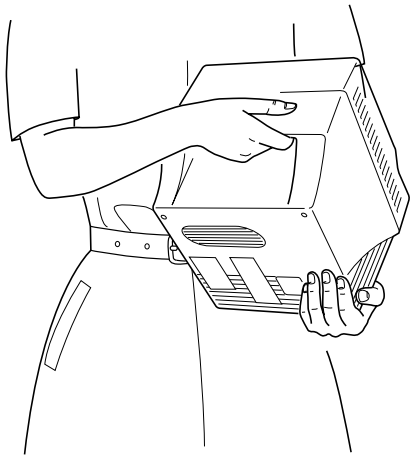


Avoid placing the monitor near a heater or humidifier.

- **When there is any problem on the monitor, turn off the power immediately and disconnect the power cord from the AC outlet. Take the monitor out of service and check for damage.**

Carrying the Monitor

Carry the monitor as shown below.



Preparing the Optional Recorder Unit

Installing the Recorder Unit

Install the optional RG-101W recorder unit in the monitor by referring to the RG-101W recorder unit installation guide (or OPV-1500 monitor service manual).

Loading the Recording Paper

CAUTION for Handling the Recording Paper

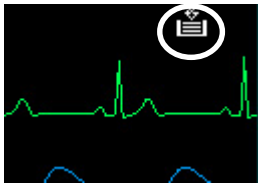
- **Do not allow paper to contact pastes, adhesive agents, oil-based felt pen tips or diazo process (ditto/spirit) copying paper. These discolor the paper surface.**
- **Do not allow paper to contact any materials made of vinyl chloride, plastic eraser, adhesive tape, fluorescent felt tip pen, or cinnabar seal ink because these discolor the recorded waveforms and data.**
- **Do not apply strong pressure to the paper. Rubbing or scratching discolors the paper surface.**
- **Do not allow paper to contact saline solution. The paper discolors and if the saline solution gets on the thermal head, there will be dots missing from the recorded data.**
- **Avoid high humidity, high temperature, direct sunlight and direct fluorescent light when storing recording paper. Otherwise the paper may discolor. Store the recording paper in a dry, cool place.**
- **When using glue on the recording paper, use glue which consists of starch, polyvinyl alcohol, gum arabic, or carboxymethyl.**

CAUTION for Loading the Recording Paper

- **Correctly load the recording paper as specified. Otherwise, recording may not be performed properly.**
- **Do not touch the recording head with any hard material. When the head is tapped with hard material, the head may crack and the heater element wire may short-circuit.**
- **Clean the head surface with the provided head cleaner pen before loading new paper. After a period of usage, paper dust may accumulate between the paper and the head surface, and good printing cannot be obtained.**

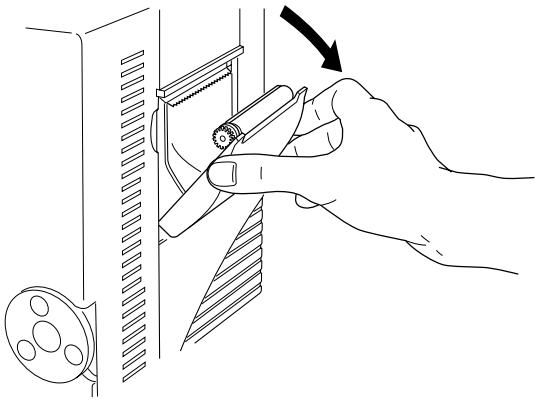
NOTE

Only use the specified recording paper, QW60-2.

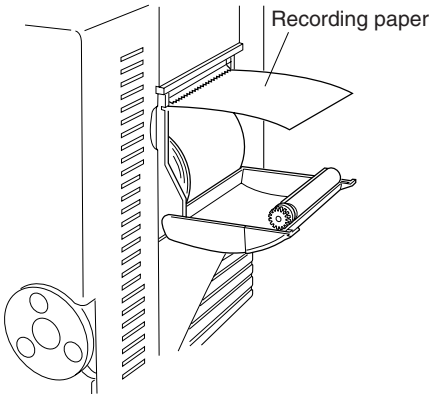


The out of paper mark appears on the screen when there is no paper.

1. Open the recorder door.

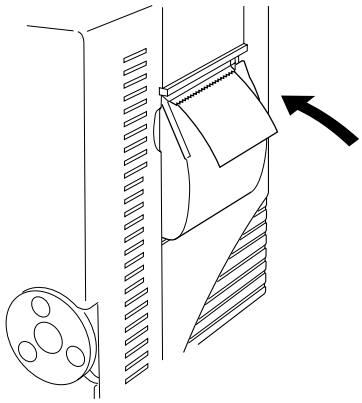


2. Set the recording paper (QW60-2) inside the recorder as shown left.



3. Draw out some paper toward you and close the recorder door.

   If the out of paper mark is still displayed on the screen, the recorder door is not closed properly.



Connecting an External Instrument to the Monitor

The optional ZB-900PK transmitter and YL-001P alarm pole can be connected to the monitor.

WARNING

For patient safety, equipotential grounding of all instruments must be performed. Consult with a qualified biomedical engineer.

When more than one electrical instrument is used, there may be electrical potential difference between the instruments. Potential difference between instruments may cause current to flow to the patient connected to the instruments, resulting in electrical shock (micro shock). Never use any medical equipment in patient treatment without proper grounding.

Always perform equipotential grounding as specified in IEC60601-1-1 when required. It is often required in the operating room, ICU room, CCU room, cardiac catheterization room and X-ray room. Consult with a biomedical engineer to determine if it is required.

Refer to the reference “General Requirements for Connecting Medical Electrical System” in Section 13.

WARNING

Connect only the specified instruments to the connector or sockets marked with ⚠ by following the specified procedure. Otherwise, electrical leakage current may harm the patient and operator.

CAUTION

Disconnect the power cord of all instruments from the AC SOURCE socket before connecting the instruments. Otherwise there may be an electrical shock.

Connecting the Optional ZB-900PK Transmitter

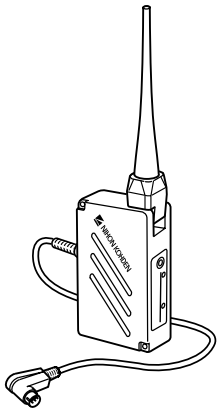
The ZB-900PK transmitter transmits data from the monitor to a cardiac telemetry system or central monitor. A multiple patient receiver is necessary with the central monitors.

CAUTION

Heart rate may differ between the monitor and the telemetry system or central monitor due to the difference on the displaying ECG waveform.

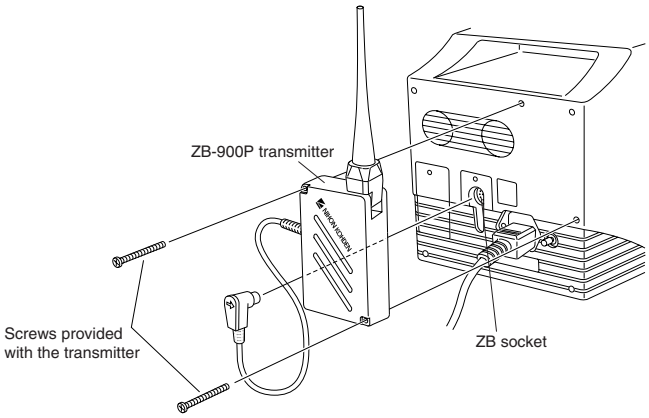
NOTE

- **Before connecting the transmitter, turn off the monitor power.**
- **The ZB-900PK transmitter frequency band is 400 MHz.**
- **The ZB-900PK transmitter is not applicable to the CE mark.**
- **A ZB-800PK transmitter cannot be used on this monitor.**

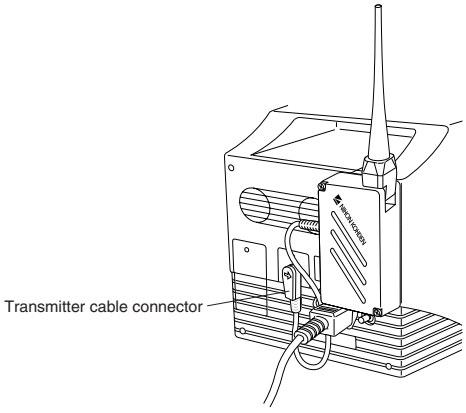


1. Check that the antenna direction of the transmitter is appropriate and that the transmitter cable is connected to the appropriate socket as shown to the left. Refer to the transmitter manual to change the cable connection.

2. Attach the transmitter to the rear panel of the monitor with the two screws provided with the transmitter as shown below. (The spacers provided with the transmitter are not required.)



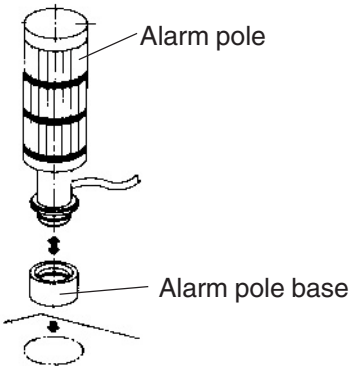
3. Connect the transmitter cable connector to the ZB socket on the monitor. Make sure that the transmitter cable is not in the way.



Connecting the Optional YL-001P Alarm Pole

CAUTION

- **Firmly connect the alarm pole connector to the alarm pole socket on the monitor. Otherwise, the lamp may not blink and an alarm may not be indicated.**
- **Do not carry the monitor by holding the alarm pole. The alarm pole may detach from the monitor and the monitor may fall off.**



1. Clean the area on the monitor where the alarm pole base is to be attached with alcohol.

2. Remove the backing paper from the bottom of the alarm pole base. Firmly press the alarm pole base to the cleaned area.

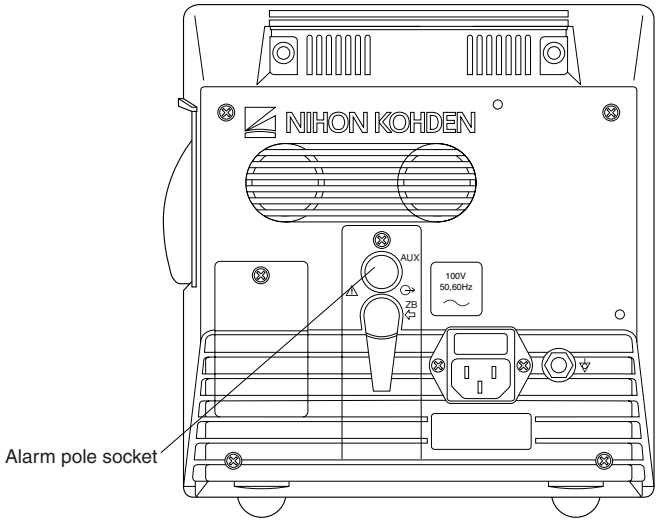
3. Insert the alarm pole into the alarm pole base.

   To remove the alarm pole from the alarm pole base, pull the alarm pole upward while holding the alarm pole base in place.

4. Connect the alarm pole cable connector to the alarm pole socket on the rear panel of the monitor.

Lamp indication

Red: crisis, yellow: warning, green: not used



Power

AC or Battery Power Source Selection

The monitor can operate on either battery or AC power.

When the power cord is plugged into an AC outlet and the power key on the front panel is turned on, the monitor operates on AC power.

When a battery is installed and the power cord is disconnected, such as when transferring a patient, the monitor automatically switches to battery power.

The battery is charged when the power cord is plugged into an AC outlet and the AC current is supplied to the monitor. The battery is also charged during monitoring.

The monitor can operate for about 1 hour with a fully charged battery pack when:
- Charged and used in normal temperature (about 25°C)
- Recorder is not used
- No alarm occurs
- Monitoring ECG, respiration and SpO_2
- NIBP measurement at 5 minute interval.

NOTE

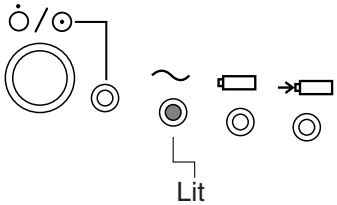
When the monitor switches from AC to battery power or UPS, or vice versa, some noise may interfere on the waveform and the numeric data may not be stable. In such a case, wait for the monitor to become stable before resuming monitoring.

Connecting the Power Cord and Grounding the Monitor

Connecting the Power Cord

WARNING

- **Only use the provided power cord. Using other power cords may result in electrical shock or other injury to the patient and operator.**
- **When the provided power cord cannot be used, operate the monitor on battery power.**



Connect the provided power cord to the AC SOURCE socket on the rear panel of the monitor and plug the cord into a 3-prong AC outlet.

When the AC power is supplied to the monitor, the AC power lamp on the front panel lights and a buzzer sounds.

NOTE

If the AC power lamp does not light and there is no “bong” sound, check the power cord connection.

Grounding the Monitor

WARNING

- **For patient safety, equipotential grounding of all instruments must be performed. Consult with a qualified biomedical engineer.**
- **When equipotential grounding is doubtful (such as in poor grounding facility), operate the monitor on battery power.**

When more than one electrical instrument is used, there may be electrical potential difference between the instruments. The potential difference between the instruments may cause current to flow to the patient connected to the instruments, resulting in electrical shock (micro shock).

Always perform equipotential grounding when required. It is often required in the operating room, ICU room, CCU room, cardiac catheterization room and X-ray room. Consult with a biomedical engineer to determine if it is required.

When equipotential grounding is required, connect the equipotential ground terminal on the instrument to the equipotential ground terminal on the wall (equipotential grounding system) with the equipotential grounding lead (potential equalization conductor).

Turning the Monitor On

Check Before Turning On the Monitor

Check the following items before turning on the monitor.

- Enough electrodes and electrode leads are ready.
- Cleaned and sterilized probes and cuffs are ready.
- Power cord is connected properly.
- Equipotential grounding lead is connected properly when equipotential grounding is required.
- All cables are connected properly.
- Batteries are fully charged when operating on battery power.
- No scratches, damage or dirt on the monitor.
- No damage to the keys, rotary dial and panels.
- No damage to the power cord.
- No damage to the electrode leads, probes and cuffs.
- The monitor is not in a wet place.
- Enough recording paper in the recorder (when using an optional recorder unit).

Turning the Monitor On

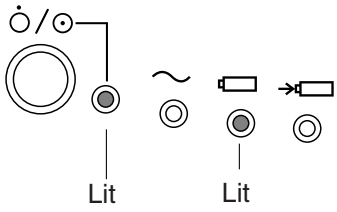
CAUTION

When the monitor power is turned on, check that one "bong" sounds and the red and yellow alarm indicators blink once to show that the alarm functions properly.

NOTE

- **It takes a few minutes for the LCD screen to reach full brightness.**
- **The shadow of the previous screen may remain for a few minutes after changing screens.**
- **There may be some dots on the LCD screen which are always on or always off, but it does not affect monitoring. This is normal for all LCD screens.**

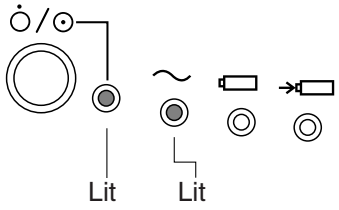
When the monitor is turned on, check that one "bong" sounds and the red and yellow alarm lamps blink once to show that the alarm functions properly.



- **When operating on battery power**
  After installing a fully charged battery pack, press the power key on the front panel to ON. The power and battery power lamps light, a buzzer sounds and the monitoring screen appears.

  If the power and battery power lamps do not light and there is no buzzer sound, check the battery condition.

  When operating on battery power, the screen brightness may be darker compared to operating on AC power.



- **When operating on AC power**
  After grounding and connecting the power cord, press the power key on the front panel to ON. The power lamp and the AC power lamp light and the monitoring screen appears.

  If the power lamp does not light, check the power cord connection.

Check After Turning On the Monitor and During Monitoring

To start monitoring safely and properly, check the following items after turning on the monitor. If any problem is detected, take the proper countermeasure according to the troubleshooting and maintenance sections.

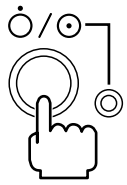
- There is no fire, smoke or smell.
- The monitor is not too hot.
- The power lamp lights.
- Alarm indicators blink once and a bong sounds.

- The monitoring screen appears.
- No error message is displayed on the screen.
- The time on the screen is correct.
- The low battery mark does not appear on the screen when operating on battery.
- The monitor does not affect surrounding equipment.
- The data and waveforms are displayed properly.
- Keys and rotary dial operate properly.
- Alarm functions properly.
- There is no trouble in recording (when using an optional recorder unit).

NOTE

After turning the monitor on and before monitoring a patient, make sure that the time displayed at the lower right of the screen is correct. The date and time of all stored data is not changed when the current date or time is changed during monitoring.

Turning the Monitor Off



1. Press the power key on the front panel for more than one second to turn the monitor off. The screen becomes dark and the power lamp on the front panel turns off.

Check After/Before Turning the Monitor Off

Check the following items for the next use.

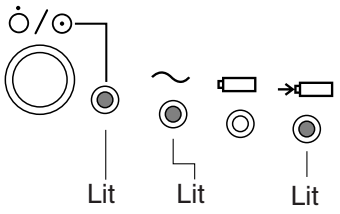
- Previous patient data is deleted.
- Temporarily changed settings are changed back to the previous settings.
- There is no dirt, damage or scratches on the monitor.
- The cuffs, probes and cables are cleaned and sterilized.
- Accessories are cleaned and stored properly.
- There are enough consumables, such as recording paper, and disposable electrodes for the next use.
- Battery pack is fully charged.
- Battery pack is removed from the monitor when not operating for a long period of time.
- The power key on the monitor is turned off and the power cord is disconnected from the monitor.
- The monitor is not in a wet place.
- Dead batteries are disposed of properly.
- The medical waste is disposed of properly.
- The monitor is stored properly.

Power and Battery Status Indications

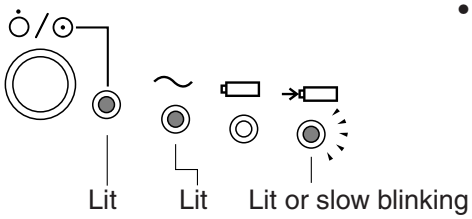
Power and battery status are indicated by four lamps on the front panel. A discharged battery is also indicated by a screen message and alarm.

NOTE

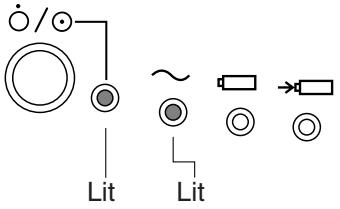
When charging the battery with the monitor power key turned off, check that the AC power lamp and battery charging lamp light. If the lamps do not light even when the power cord is connected and the battery is inserted, turn the power key on, check that the battery charging lamp is blinking or lit, then turn the power key off.



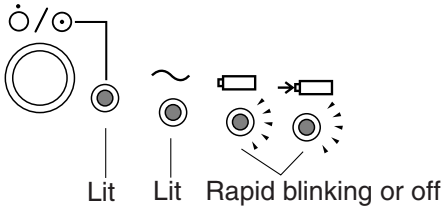
- Operating on AC power and battery is fully charged
  - Power lamp: Lit
  - AC power lamp: Lit
  - Battery power lamp: Off
  - Battery charging lamp: Lit



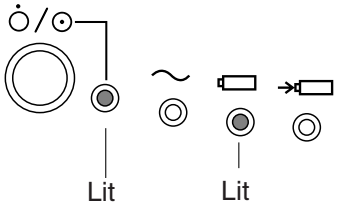
- Operating on AC power and battery is being charged
  - Power lamp: Lit
  - AC power lamp: Lit
  - Battery power lamp: Off
  - Battery charging lamp: Slow blinking (once every 2 seconds) or lit



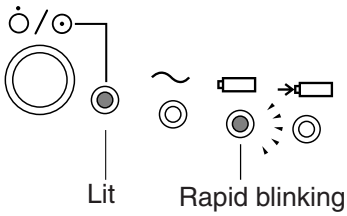
- Operating on AC power with no battery
  - Power lamp: Lit
  - AC power lamp: Lit
  - Battery power lamp: Off
  - Battery charging lamp: Off



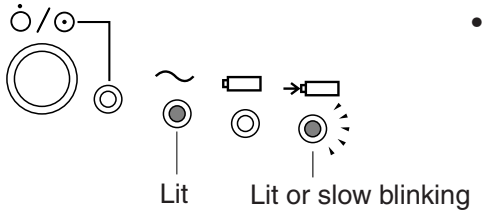
- Operating on AC power and battery is damaged
  - Power lamp: Lit
  - AC power lamp: Lit
  - Battery power lamp: Rapid blinking (4 times per second) or off
  - Battery charging lamp: Rapid blinking (4 times per second) or off



- Operating on battery power
  - Power lamp: Lit
  - AC power lamp: Off
  - Battery power lamp: Lit
  - Battery charging lamp: Off



- Operating on battery power and battery needs recharging
  - Power lamp: Lit
  - AC power lamp: Off
  - Battery power lamp: Rapid blinking (4 times per second)
  - Battery charging lamp: Off
  - Screen indication: “LOW BATTERY” message
  - Alarm indication: Continuous “bing bong” sound and blinking yellow alarm lamp



- No monitoring and charging battery

Power lamp:	Off
AC power lamp:	Lit
Battery power lamp:	Off
Battery charging lamp:	Slow blinking (once every 2 seconds) or lit

Battery Handling and Operation

Safety Information

WARNING

- **Keep the battery pack away from fire. Otherwise the battery pack may explode.**
- **Do not heat the battery pack. The battery pack may explode.**
- **Never short-circuit the + and – terminals on the battery pack with a wire or store the battery pack with metals such as necklace or hair pins. The battery pack may short-circuit, causing the substance inside the battery to leak or explode.**
- **Never disassemble or modify the battery pack. Never damage or directly solder the sheath tube. The battery pack short-circuits, the electrolyte comes out and the battery pack explodes.**
- **Do not subject the battery pack to a strong mechanical shock. The battery may leak or explode.**
- **Do not use a battery which is damaged, such as from falling. There is a gas discharge valve inside the battery and if this valve is damaged, the gas cannot be discharged, causing the battery to explode.**
- **Only use the battery pack on the specified instrument. If the battery is used on an unspecified instrument, large current may flow, causing the battery to explode.**
- **If the battery pack is damaged and the substance inside the battery (alkaline liquid) contacts the eyes or skin, wash immediately and thoroughly with water and see your physician. Never rub your eyes, otherwise you may lose your eyesight.**
- **The battery pack has + and – polarity. Make sure that the battery is installed with the correct polarity direction. Otherwise, the substance inside the battery may leak and explode.**
- **Do not connect the battery pack to an AC outlet or lighter socket in a car. The battery may explode.**
- **Do not immerse the battery pack in water or seawater. The battery will rust and may heat up.**
- **Never use a battery pack which is damaged, discolored or has leakage. A damaged battery may explode if used.**

CAUTION

- **Do not expose the battery pack to direct sunlight or leave in a high temperature place. The lifetime of the battery pack may be shortened**

or the substance inside the battery pack may leak.
- **The battery pack must be replaced by qualified service personnel.**
- **Keep the battery pack away from children.**
- **Before disposing of the battery, check with your local solid waste officials for details in your area for recycling options or proper disposal. The battery is recyclable. At the end of its useful life, under various state and local laws, it may be illegal to dispose of this battery into the municipal waste stream.**

NOTE

- **Fully charge the new battery pack before using on the monitor.**
- **Do not use a battery pack which is past the expiration date written on the label.**
- **Always charge the battery between 10°C (50°F) and 30°C (86°F). Temperatures out of this range affect the working of the battery and may cause it to leak or explode.**
- **Do not leave a battery pack inside the monitor without the power cord connected between the monitor and AC outlet. The battery pack may be over-discharged and can no longer be used.**
- **When not using the monitor for a long period of time (more than six months), remove the battery pack from the monitor and store the battery at temperatures between –20°C (–4°F) and +30°C (86°F) and low humidity.**
- **Before disposing of the monitor, make sure that the battery pack is removed from the monitor.**

Battery Lifetime

The battery pack lifetime is one year or 300 cycles of discharging/charging. Write the date of first use of the battery on the start date label provided with the battery pack and attach it to the bedside monitor where it is easy to see (upper part of the right side panel recommended). Write the same date on the label of the battery pack.

Battery Handling Procedures

- Use a battery until it is fully discharged (LOW BATTERY message appears), then fully charge the battery. The battery life will be longer if it is fully discharged before charging it again.
- Replace the battery with a new one after 300 cycles of discharging/charging or after one year, whichever comes first. This is because the battery is a chemical product which gradually deteriorates whether or not it is used.

When Using a Battery for the First Time or After Storage

- Fully recharge the battery before using it for the first time or after storing it for over a month. When the battery is not used, it self-discharges.

When Not Using the Monitor or Battery

WARNING

Do not leave the battery for more than two years unused. The battery may leak.

- When the monitor is not used (about 6 months), remove the battery. When a charged or discharged battery is left inside the monitor with the power cord unplugged, the battery self-discharges and deteriorates.
- When a battery is not used, fully charge it before storage. When a battery is not used for over one month, fully charge it before use.
- Store the battery packs under the following conditions.
  Temperature: –20 to 30°C (–4 to 86°F)
  Humidity: 65% ±20% relative humidity

When the LOW BATTERY Message Appears

When the "LOW BATTERY" message highlighted in yellow appears, continuous "bing bongs" sound and the yellow alarm indicator blinks, the battery power is weak. Connect the power cord to the monitor, operate the monitor on AC power and charge the battery.

If no AC or battery power is supplied to the monitor, there is no measurement or display but no data is lost.

Installing or Replacing the Battery

The battery pack must be installed or replaced by qualified service personnel. Refer to the bedside monitor service manual.

Charging the Battery

The battery pack can only be charged by the monitor. It takes about 2 hours and 40 minutes to charge a battery pack on the monitor.

The monitor can operate for about 1 hour with a fully charged battery pack when:
• Charged and used in normal temperature (about 25°C)
• Recorder is not used
• No alarm occurs
• Monitoring ECG, respiration and SpO_2
• NIBP measurement at 5 minute intervals.

CAUTION

When charging the battery pack, keep the ambient temperature at approximately 20°C to maintain the optimal battery operation time. If the battery pack is charged at less than 10°C (50°F) or more than 40°C

(72°F), the maximum battery operation time will be 20% to 30% less than the optimal operation time.

During AC operation, the battery is automatically charged without interrupting monitoring. It takes approximately 2 hours and 40 minutes of continuous charging to fully charge the battery pack. After 2 hours and 40 minutes of continuous charging, the monitor automatically switches to trickle charging mode to maintain the battery pack fully charged. Trickle charging is necessary because the battery pack can self-discharge even when it is not in use.

NOTE

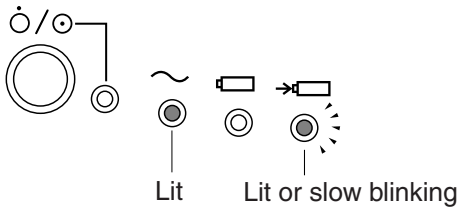
- **Do not disconnect the power cord from the monitor during battery charging.**
- **If the 2 hours and 40 minutes of continuous normal charging is disrupted for more than one hour by power failure in the main power supply or by temporary removal of the battery pack from the monitor, the monitor's normal charging circuit is reset, and the battery pack is charged for another 2 hours and 40 minutes regardless of how many hours it was charged before the disruption. This deteriorates the battery.**

1. Install the battery pack into the monitor.

2. Connect the power cord to the monitor and the AC outlet. The monitor charges the battery pack regardless of whether the monitor power key is on or off.

   During charging, the battery charging lamp on the front panel blinks.

   After 2 hours and 40 minutes, the battery charging lamp is continuously lit and the battery charging is completed.



Disposal of Battery Pack

Before disposing of the battery, check with your local solid waste officials for details in your area for recycling options or proper disposal. The battery is recyclable. At the end of its useful life, under various state and local laws, it may be illegal to dispose of this battery into the municipal waste stream.

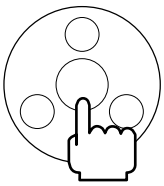
Changing Date and Time Setting

When the monitor power is on, the current time is displayed in the lower right corner of the monitoring screen.

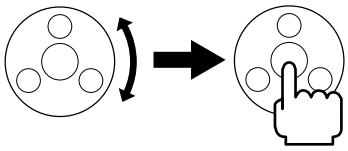
NOTE

The date and time of all stored data is not changed when the current date or time is changed during monitoring.

The date format can be changed at DATE FORMAT on the SYSTEM SETUP screen. Refer to Section 3.



1. From the monitoring screen, press the rotary dial center key on the front panel. The ALARM window opens.



2. Turn the rotary dial to select “OTHER” and press the rotary dial center key to enter the OTHER window. The cursor moves to the “WAVE DISP” box.

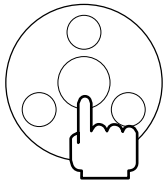
3. Turn the rotary dial to move the cursor to date, press the rotary dial center key to change the cursor color to blue, turn the rotary dial to select setting and press the rotary dial center key to register the setting.

To change the time, turn the rotary dial to move the cursor to time, press the rotary dial center key to change the cursor color to blue, turn the rotary dial to select setting and press the rotary dial center key to register the setting.

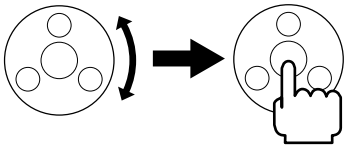
4. To return to the monitoring screen, select “CLOSE” on the OTHER window or press the HOME/REVIEW key on the front panel.

Turning the Click Sound for Key Operation On or Off

The click sound for the key and rotary dial operation can be turned on or off.



1. From the monitoring screen, press the rotary dial center key on the front panel. The ALARM window opens.



2. Turn the rotary dial to select “REC/SOUND” and press the rotary dial center key to enter the REC/SOUND window. The cursor moves to the “REC SPEED” box.

3. Turn the rotary dial to move the cursor to “CLICK” and press the rotary dial center key to select ON or OFF.

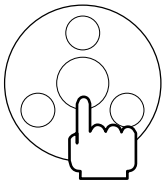
4. To return to the monitoring screen, select “CLOSE” on the REC/SOUND window or press the HOME/REVIEW key on the front panel.

Deleting All Stored Data

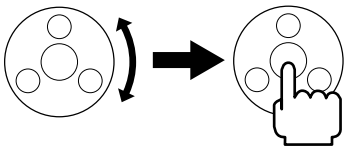
When monitoring the patient is no longer required, delete the stored data.

CAUTION

Before monitoring a new patient, first delete all data of the previous patient. Otherwise, the data of the previous patient and new patient will be mixed together.



1. From the monitoring screen, press the rotary dial center key on the front panel. The ALARM window opens.



2. Turn the rotary dial to select “OTHER” and press the rotary dial center key to enter the OTHER window. The cursor moves to the “WAVE DISP” box.

3. Turn the rotary dial to move the cursor to “DELETE ALL”, press the rotary dial center key to change the cursor color to blue, turn the rotary dial to select “YES” and press the rotary dial center key to delete data.

   To not delete data, select “NO” and press the rotary dial center key.

4. To return to the monitoring screen, select “CLOSE” on the REC/SOUND window or press the HOME/REVIEW key on the front panel.

Section 3 Changing System Setup Settings

Displaying the SYSTEM SETUP Screen 3.2
- Changing Settings 3.3
- Closing the SYSTEM SETUP Screen and Displaying the Monitoring Screen 3.3

List and Explanation of the SYSTEM SETUP Settings 3.4
- List of All Settings 3.4
- BASIC SETTINGS 3.5
- ALARM SETUP 3.6
- NIBP SETUP 3.7
- SpO2 SETUP 3.8
- ECG/RESP SETUP 3.9

Initializing the System 3.10

Factory Default Settings 3.12
- SYSTEM SETUP Screen 3.12
- ALARM Window 3.12
- NIBP Window 3.12
- ECG etc Window 3.13
- REC/SOUND Window 3.13
- OTHER Window 3.13

This section explains how to change settings after the monitor is installed and before monitoring waveforms.

The initial settings on the SYSTEM SETUP screen must be changed before monitoring. Changing these settings during monitoring interrupts monitoring.

All other settings can be changed any time without interrupting monitoring.

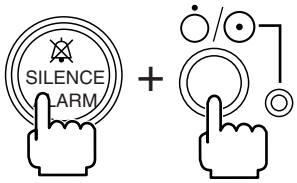
This section also explains how to initialize the system. This procedure returns all settings to the factory default settings and deletes all stored data in memory.

Displaying the SYSTEM SETUP Screen

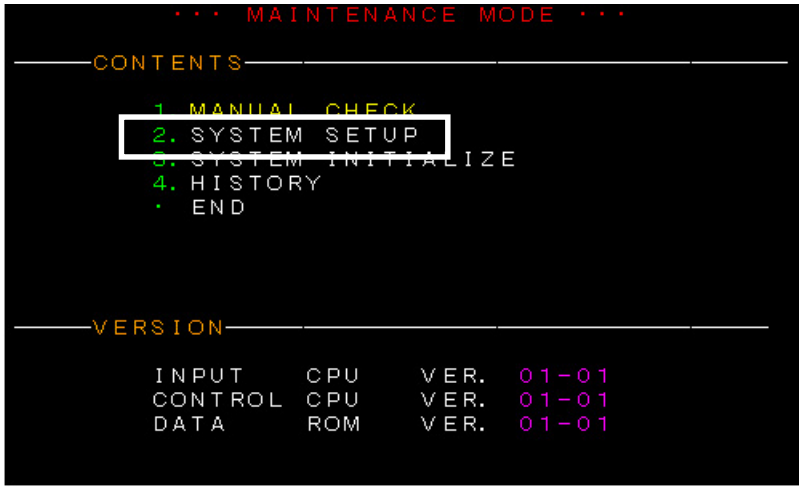
WARNING

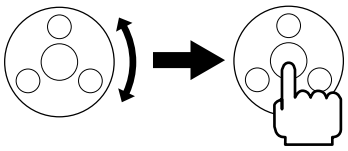
This procedure interrupts all monitoring. Only change these settings before or after monitoring.

1. Turn the monitor power off.

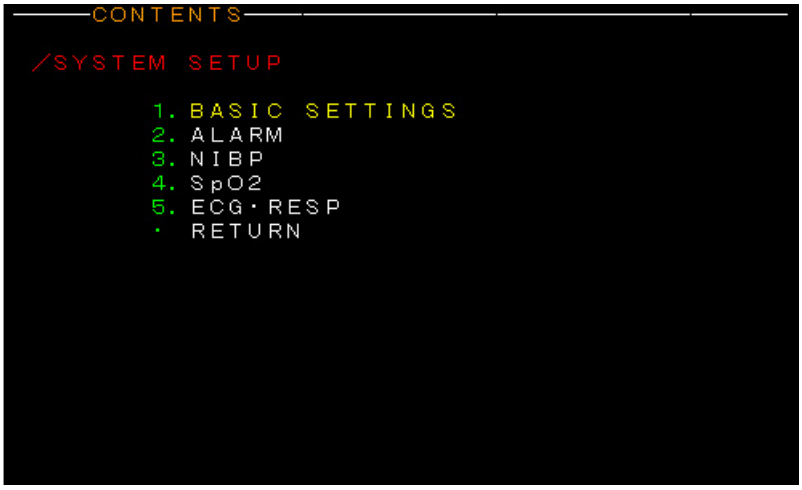


2. Press the power key while pressing the SILENCE ALARM key on the front panel until the MAINTENANCE MODE screen is displayed.

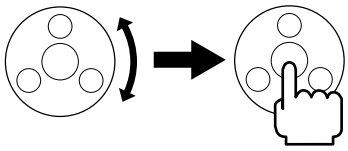




3. Turn the rotary dial to select “2. SYSTEM SETUP” and press the rotary dial center key. The SYSTEM SETUP screen appears.



Changing Settings



1. Select the desired setup item on the SYSTEM SETUP screen by turning the rotary dial and pressing the rotary dial center key. A setup screen for that item appears.

2. Select a setting item on the screen by turning the rotary dial and pressing the rotary dial center key.

3. Turn the rotary dial to select the condition and press the rotary dial center key to register the setting.

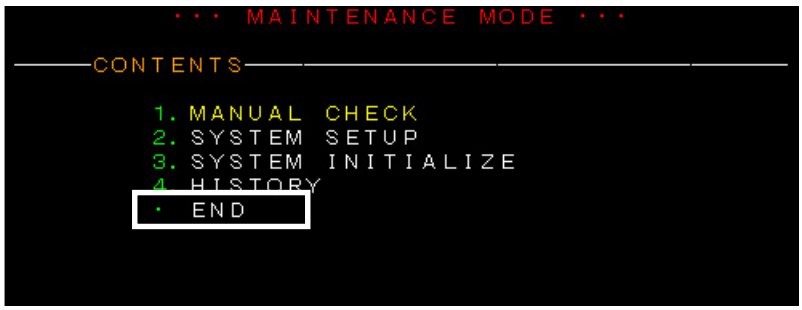
4. Select “RETURN” by turning the rotary dial and press the rotary dial center key to return to the SYSTEM SETUP screen.

5. Repeat steps 1 to 4 to change other setup settings.

Closing the SYSTEM SETUP Screen and Displaying the Monitoring Screen

1. After you change all desired settings, select “RETURN” on the SYSTEM SETUP screen by turning the rotary dial and press the rotary dial center key. The new settings are entered and the screen returns to the MAINTENANCE MODE screen.

2. Select “END” by turning the rotary dial and press the rotary dial center key. After a few seconds, the monitoring screen appears.



List and Explanation of the SYSTEM SETUP Settings

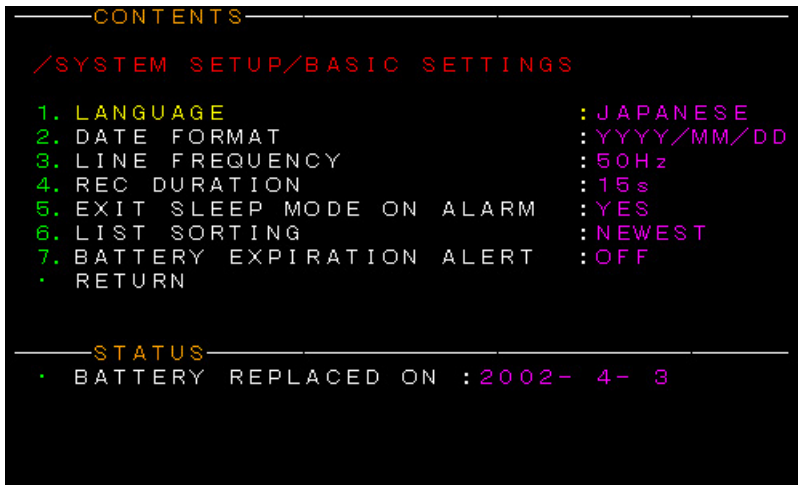
List of All Settings

The factory default settings are underlined.

SETUP type	Item	Setting Conditions
BASIC SETTINGS	1. LANGUAGE	ENGLISH, JAPANESE
	2. DATE FORMAT	YYYY/MM/DD, MM-DD-YYYY, DD-MM-YYYY
	3. LINE FREQUENCY	50 Hz, 60 Hz
	4. REC DURATION	7.5, 15, 30, 60 s*
	5. EXIT SLEEP MODE ON ALARM	YES, NO
	6. LIST SORTING	NEWEST, OLDEST
	7. BATTERY EXPIRATION ALERT	OFF, ON, SET DATE
ALARM	1. SAVE ALARM SETUP	YES, NO
	2. ALARM FREQUENCY (ADVISORY)	20, 40, 60, 120 s
	3. ALARM LEVEL OF APNEA	CRISIS, WARNING
NIBP	1. NIBP MODE AFTER STAT	MANUAL, 2 min, 2.5 min, 5 min, 10 min, 15 min, 30 min
	2. NIBP COMPLETED SOUND	ON, OFF
	3. DIM OLD NIBP DATA	OFF, 10, 30, 60, 120, 180 min
	4. PRESSURE UNIT	mmHg, kPa
	5. INIT CUFF PRESS (Adult mmHg)	120 to 240 mmHg, 180 mmHg
	6. INIT CUFF PRESS (Adult kPa)	16.0 to 32.0 kPa, 24.0 kPa
	7. INIT CUFF PRESS (Neo mmHg)	60 to 140 mmHg, 100 mmHg
	8. INIT CUFF PRESS (Neo kPa)	8.0 to 18.0 kPa, 13.0 kPa
SpO2	1. SpO2 RESPONSE	FAST, NORMAL, SLOW
	2. PROBE OFF DETECTION	ON, OFF
ECG•RESP	1. PACING MARKER	ON, OFF
	2. SYNC SOUND PITCH	LOW, HIGH
	3. DRIFT FREE FILTER	ON, OFF
	4. AC LINE NOISE FILTER	ON, OFF
	5. HIGH CUT FILTER (40 Hz)	ON, OFF
	6. NOISE REDUCTION ON RESP	ON, OFF

* These durations are when the recording speed is at 25 mm/s. The duration differs according to the recording speed. The recording speed is set at REC SPEED on the REC/SOUND window of the setup window.

BASIC SETTINGS



1. LANGUAGE: ENGLISH, JAPANESE

Select English or local language screen description.

2. DATE FORMAT: YYYY/MM/DD, MM-DD-YYYY, DD-MM-YYYY

Select date format.

YYYY: year, MM: month, DD: day

3. LINE FREQUENCY: 50 Hz, 60 Hz

Select line frequency of your area to reduce AC interference in SpO_2 monitoring.

NOTE

Make sure that the appropriate line frequency is selected. Otherwise, noise may interfere on the pulse waveform.

4. REC DURATION: 7.5, 15, 30, 60 s

Select recording duration for manual recording. These durations are when the recording speed is at 25 mm/s. When the recording speed is 12.5 mm/s, the duration is doubled and when the recording speed is 6.25 mm/s, the duration is four times that of 25 mm/s.

5. EXIT SLEEP MODE ON ALARM: YES, NO

YES: When an alarm occurs during sleep mode, the sleep mode is exited and the monitoring screen appears.

NO: The sleep mode continues even when an alarm occurs.

WARNING

When EXIT SLEEP MODE ON ALARM is set to NO, the bedside monitor alarm cannot be seen or heard on the bedside monitor during sleep mode. Attach the transmitter (optional) to the monitor and monitor the bedside monitor alarm on the central monitor or telemetry system. Otherwise, bedside monitor alarms may be overlooked.

6. LIST SORTING: NEWEST, OLDEST

Select the list displaying order.

NEWEST: The latest data comes at the top.

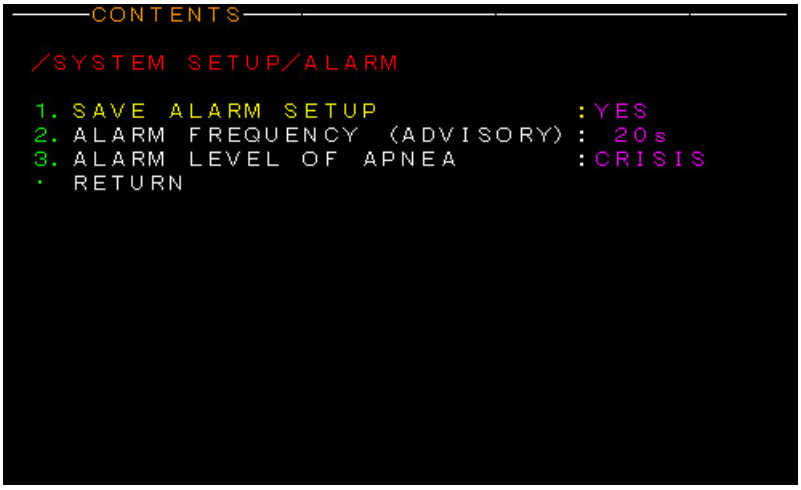
OLDEST: The oldest data comes at the top.

7. BATTERY EXPIRATION ALERT: ON, OFF, SET DATE

An “INSERT NEW BATTERY” message can be displayed one year after installing the new battery in the monitor.

To display the message, select “ON” and then select “SET DATE”. Today’s date is displayed in the STATUS column at the lower part of the screen. The “INSERT NEW BATTERY” message will be displayed one year after this date for 5 seconds after turning on the monitor.

ALARM SETUP



1. SAVE ALARM SETUP: YES, NO

YES: Saves alarm settings after monitor power off.

NO: Alarm settings return to the initial settings 30 minutes after monitor power off.

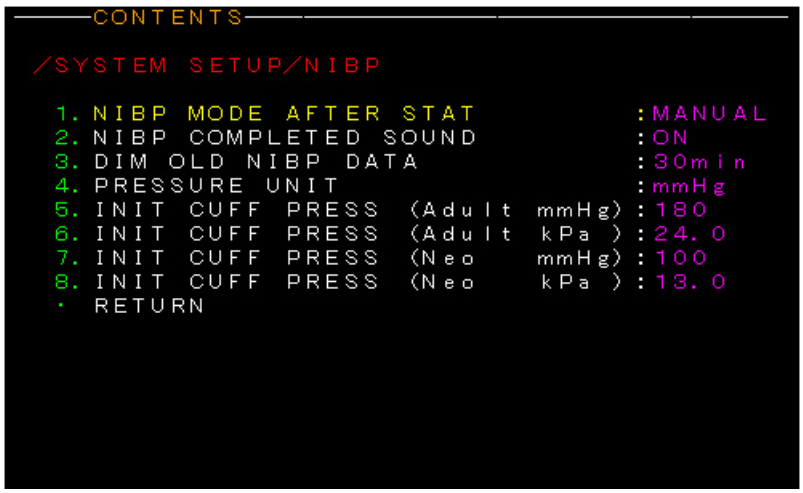
2. ALARM FREQUENCY (ADVISORY): 20, 40, 60, 120 s

Select the interval of the alarm sound (bongs) of the ADVISORY level alarm.

3. ALARM LEVEL OF APNEA: CRISIS, WARNING

Select the alarm level for the APNEA alarm.

NIBP SETUP


CONTENTS
/SYSTEM SETUP/NIBP
1. NIBP MODE AFTER STAT :MANUAL
2. NIBP COMPLETED SOUND :ON
3. DIM OLD NIBP DATA :30min
4. PRESSURE UNIT :mmHg
5. INIT CUFF PRESS (Adult mmHg) :180
6. INIT CUFF PRESS (Adult kPa) :24.0
7. INIT CUFF PRESS (Neo mmHg) :100
8. INIT CUFF PRESS (Neo kPa) :13.0
· RETURN

1. NIBP MODE AFTER STAT: MANUAL, 2, 2.5, 5, 10, 15, 30 min

The NIBP measurement mode after completing STAT (continuous) measurement changes to the Manual mode or Auto mode with the selected interval.

2. NIBP COMPLETED SOUND: ON, OFF

ON: When NIBP measurement is completed, one “bong” sounds.

OFF: No sound.

3. DIM OLD NIBP DATA: OFF, 10, 30, 60, 120, 180 min

Select the duration time after NIBP measurement for the NIBP data to become dim. When OFF is set, the NIBP data does not become dim.

4. PRESSURE UNIT: mmHg, kPa

Select the unit for NIBP.

5. INIT CUFF PRESS (Adult mmHg): 120 to 240 mmHg

6. INIT CUFF PRESS (Adult kPa): 16.0 to 32.0 kPa

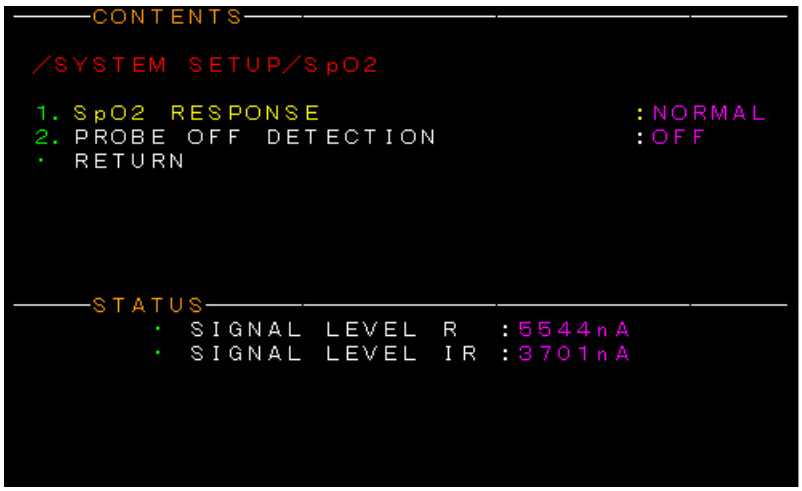
Select the initial cuff inflation pressure for measuring an adult or child.

7. INIT CUFF PRESS (Neo mmHg): 60 to 140 mmHg

8. INIT CUFF PRESS (Neo kPa): 8.0 to 18.0 kPa

Select the initial cuff inflation pressure for measuring a neonate.

SpO2 SETUP



1. SpO2 RESPONSE: FAST, NORMAL, SLOW

Each response mode uses a different time to enable accurate measurements according to patient conditions. When measurement condition is unstable, response becomes slower in all modes.

FAST: Select this mode for special applications that require a fast response. "FAST" is suitable for detecting short apnea.
NORMAL: For normal monitoring.
SLOW: Select this mode when you need to suppress a rapid change in SpO_2.

2. PROBE OFF DETECTION: ON, OFF

ON: Detects probe off for SpO_2 monitoring.
OFF: Does not detect probe off for SpO_2 monitoring.

STATUS: SIGNAL LEVEL

The signal level shows the receiving current of the LED on the TL-201T finger probe. Put the check board provided with the SpO_2 connection cord between the light emitter and photo detector of the probe. Replace the probe with a new one when the signal level becomes half of the level at the first use. Use the table attached at the end of this manual for writing the signal level. Refer to the service manual for details.

R: red emitter, IR: infrared emitter

ECG/RESP SETUP

CONTENTS
/SYSTEM SETUP/ECG·RESP
1. PACING MARKER :OFF
2. SYNC SOUND PITCH :HIGH
3. DRIFT FREE FILTER :ON
4. AC LINE NOISE FILTER :ON
5. HIGH CUT FILTER (40Hz) :ON
6. NOISE REDUCTION ON RESP :OFF
· RETURN

1. PACING MARKER: ON, OFF

When set to ON, the pacing mark can be displayed on the ECG.

2. SYNC SOUND PITCH: LOW, HIGH

High or low pitch synchronized sound can be selected.

3. DRIFT FREE FILTER: ON, OFF

When set to ON, this filter prevents ECG baseline drift.

4. AC LINE NOISE FILTER: ON, OFF

When set to ON, this filter reduces AC interference from the ECG.

5. HIGH CUT FILTER (40 Hz): ON, OFF

When set to ON, this filter removes noise from the ECG at 40 Hz.

6. NOISE REDUCTION ON RESP: ON, OFF

In the impedance method, noise from the heart beat may interfere on the respiration waveform due to electrode position or when monitoring a neonate, and the respiration rate may increase to almost the same rate as the heart rate. In such a case, set this setting to ON to reduce noise interference on the respiration waveform.

In normal monitoring of an adult, set this item to OFF. Otherwise, the respiration rate may be miscounted.

NOTE

When this item is set to ON and the timing of the respiration and heart beat coincide, respiration rate may not be counted. In such a case, set this item to OFF or check the patient's respiration by observing the patient's chest movement or the respiration waveform on the monitoring screen.

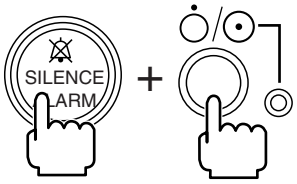
Initializing the System

Usually, this procedure is not performed. Use the following procedure to initialize the monitor to the factory default settings. The factory default settings are listed in the “Factory Default Settings” section.

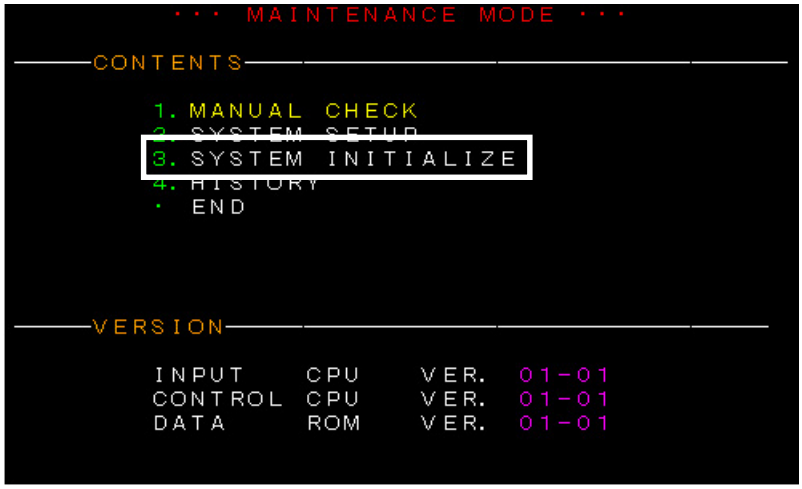
CAUTION

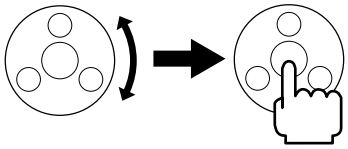
All patient data, stored data and error history are deleted and all settings return to the factory default settings.

1. If turned on, turn off the monitor power.



2. Press the power key while pressing the SILENCE ALARMS key on the front panel until the MAINTENANCE MODE screen is displayed.





3. Turn the rotary dial to select “3. SYSTEM INITIALIZE” and press the rotary dial center key. The SYSTEM INITIALIZE screen is displayed.

4. Select “EXECUTE” and press the rotary dial center key to initialize the settings.

   When initializing is finished, the “OK” message appears.

   To not initialize the settings or return to the MAINTENANCE MODE screen after initialization, turn the rotary dial to select “RETURN” and press the rotary dial center key.

When the monitor is initialized, the language setting is changed to JAPANESE. Change the language to ENGLISH on “1. LANGUAGE” on the BASIC SETTINGS screen of the SYSTEM SETUP screen.

Factory Default Settings

This section shows the available settings. The factory default settings are underlined.

OK: Remains in memory even when the monitor is turned off.
30 min: Remains in memory for at least 30 minutes after turning the monitor off. After 30 minutes, the setting changes back to the default setting.

SYSTEM SETUP Screen

Refer to the "List and Explanation of the SYSTEM SETUP Settings" section.

ALARM Window

Items	Settings	Backup
NIBP SYS (mmHg) Adult/child	Upper: 15 to 260, OFF (5 steps), 180 Lower: 10 to 255, OFF (5 steps), 80	When SAVE ALARM SETUP on the SYSTEM SETUP screen is set to: YES: OK NO: 30 min
NIBP SYS (mmHg) Neonate	Upper: 10 to 125, OFF (5 steps), 100 Lower: 5 to 120, OFF (5 steps), 50	
NIBP SYS (kPa) Adult/child	Upper: 1.5 to 35.0, OFF (0.5 steps), 24.0 Lower: 1.0 to 34.5, OFF (0.5 steps), 10.5	
NIBP SYS (kPa) Neonate	Upper: 1.5 to 17.0, OFF (0.5 steps), 13.5 Lower: 1.0 to 16.5, OFF (0.5 steps), 5.5	
HR/PR (beats/min)	Upper: 20 to 300, OFF (5 steps), 140 Lower: 15 to 295, OFF (5 steps), 40	
SpO_2 (%)	Upper: 51 to 100, OFF (1 steps), OFF Lower: 50 to 99, OFF (1 steps), 90	
RR (breaths/min)	Upper: 2 to 150, OFF (2 steps), OFF Lower: 0 to 148, OFF (2 steps), OFF	
APNEA (s)	5 to 40, OFF (5 steps), OFF	

NIBP Window

Items	Settings	Backup
INTERVAL (min)	STAT, 1, 2, 2.5, 5, 10, 15, 30, 60, 120, 240	OK
ALARM MEAS	ON, OFF	30 min
ΔPWTT (ms)	OFF, ±10 to 100 ms	

ECG etc Window

Items	Settings	Backup
ECG SENS	AUTO, ×1/4, ×1/2, ×1, ×2, ×4	30 min
ECG LEAD	I, II, III	
PACING DETECT	ON, OFF	
SpO2 SENS	AUTO, ×1/8, ×1/4, ×1/2, ×1, ×2, ×4, ×8	
SYNC SRCE	AUTO, ECG, SpO2	OK
SpO2 PITCH	ON, OFF	
RESP SENS	OFF, ×1/4, ×1/2, ×1, ×2, ×4	30 min

REC/SOUND Window

Items	Settings	Backup
REC SPEED	6.25, 12.5, 25 mm/s	OK
ALARM REC	ON, OFF	
AUTO LIST REC	ON, OFF	
ALARM (volume)	8 steps, 4	
SYNC VOL	8 steps, 4	
CLICK	ON, OFF	

OTHER Window

Items	Settings	Backup
WAVE DISP	1: AUTO/2: AUTO, 1: AUTO/2: OFF, 1: ECG/2: ECG, 1: ECG/2: SpO2, 1: ECG/2: RESP, 1: SpO2/2: RESP, 1: ECG/2: OFF, 1: SpO2/2: OFF 1: RESP/2: OFF, 1: OFF/2: OFF	30 min
LIST INTERVAL (min)	OFF, 1, 5, 15, 30, 60	
DELETE ALL	YES, NO	—
Year	2001 to 2099	OK
Month	01 to 12	
Day	01 to 31	
Hour	00 to 23	
Minute	00 to 59	

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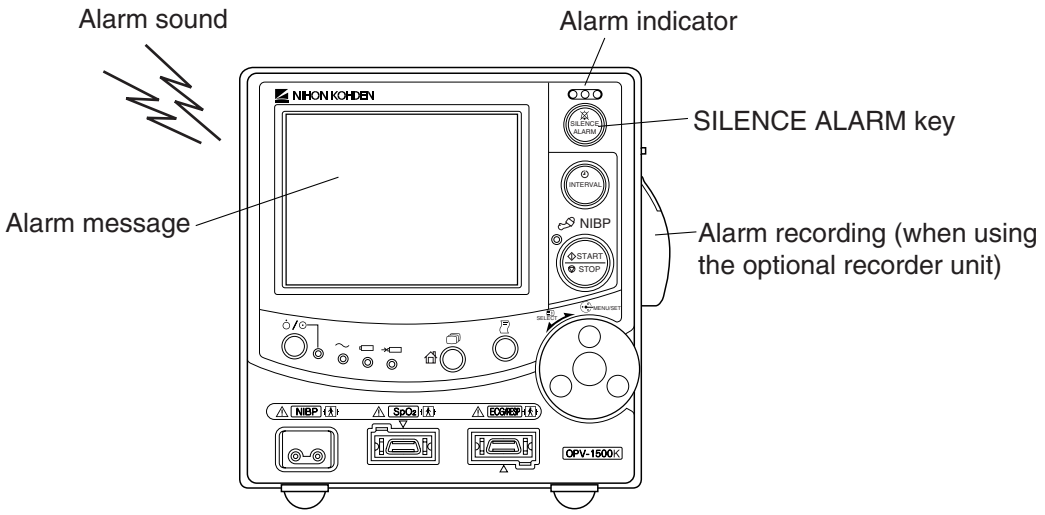
This section explains:

- An overview of alarms.
- Alarm types.
- Alarm indications.
- Silencing an alarm. When an alarm occurs, you can temporarily turn off the alarm indications. This feature is useful if you are already attending to the patient and don't need the alarm.
- Setting individual alarms and turning automatic alarm recording on or off.

Overview of Alarms

What is an Alarm

When the monitor detects an abnormal patient condition, it can generate an alarm sound, screen indication, and alarm lamp indication. You can set each individual alarm condition. There are three types of alarms: vital signs, parameter and other alarms, and three levels of alarm: crisis, warning and advisory. The different alarm types are fully explained in the "Alarm Types" section and different alarm levels are explained in the "Alarm Indications" section.



Alarm Level

There are three alarm levels.

CRISIS: Patient is in a critical condition and patient life may be at risk. Immediate action must be taken.

WARNING: Patient is in a critical condition. Prompt action should be taken. Electrodes or probe off, or incorrect lead or other cable connections may also cause this alarm.

ADVISORY: Electrodes, probe, cuff, lead and other cable connections or settings on the monitor are not appropriate for accurate measurement. Prompt action should be taken.

Alarm Priority

When several alarms occur at the same time, the alarm with the highest alarm level is indicated. When several alarms with the same alarm level occur at the same time, the alarms are indicated one after another.

Silencing an Alarm

You can temporarily silence current alarm sounds and indications for a 2 minute period. See the “Temporarily Silencing/Suspending Alarms” section.

WARNING

During alarm suspension, all current alarms are temporarily turned off.

Automatic Recording

With an optional RG-101W recorder unit, you can set the monitor to automatically record waveforms and data when a vital sign alarm occurs. See the “Turning Automatic Alarm Recording On/Off” section.

Alarm Setting

Usually, alarms are set before monitoring, but alarms can be set or changed anytime without interrupting monitoring.

When SAVE ALARM SETUP is set to YES on the SYSTEM SETUP screen, all alarm settings are saved after monitor power off. When set to NO, all alarm settings return to the factory default settings 30 minutes after monitor power off. Refer to Section 3.

To set a vital sign alarm to off, set the upper and lower limits to OFF.

Adjusting Alarm Sound Volume

The alarm sound volume can be adjusted on the REC/SOUND window. At the lowest setting, the alarm sound is still audible. Refer to the “Changing Alarm Sound Volume” section.

Alarm Types

Alarms are divided into 3 categories: vital signs, parameter and other alarms. The alarm name is displayed on the screen when an alarm occurs. For the vital signs alarms, waveforms and data can be recorded on the optional recorder unit in automatic alarm recording.

Vital Signs Alarms

Alarm Name	Description
Heart rate/pulse rate alarm	High/low limit exceeded
SpO2 alarm	High/low limit exceeded
NIBP systolic alarm	High/low limit exceeded (systolic)
Respiration rate alarm	High/low limit exceeded
APNEA alarm	Limit exceeded

Parameter Alarms

ECG/Respiration Related Alarms

Alarm Name	Description
ECG CONNECTOR OFF	ECG connection cord is disconnected from the ECG/RESP socket during monitoring.
CHECK ELECTRODE	Electrode loose or disconnected.

SpO_2 Related Alarms

Alarm Name	Description
SpO2 PROBE FAULT	SpO2 probe or connection cord is damaged.
SpO2 MODULE FAILURE	SpO2 hardware malfunction.
SpO2 LIGHT INTERFERENCE	A surgical light, bilirubin lamp or sunlight is close to the probe.
SpO2 NO PROBE	SpO2 connection cord is disconnected from the SpO2 socket during monitoring.
SpO2 CHECK PROBE	Finger probe is not attached to the patient firmly or the amount of transmitted light is too small to measure.
SpO2 CANNOT DETECT PULSE	Pulse cannot be detected.

NIBP Related Alarms

Alarm Name	Description
NIBP SAFETY VALVE OPEN	Instrument automatically stopped inflating.
NIBP CHECK INTERVAL	Auto measurement at 1 minute intervals is performed for more than 30 minutes.
NIBP HARDWARE ERROR	NIBP hardware malfunction.
NIBP NO PULSE	Measurement cannot be performed because the patient's pulse wave is small, the cuff or hose leaks air, the cuff hose is obstructed or the cuff is not connected.
AIR HOSE OFF	NIBP hose is disconnected from the cuff socket during monitoring.
CUFF OCCLUSION	The cuff pressure does not decrease after measurement has completed.
AIR LEAK	Cuff pressure does not change after inflation. The cuff or air hose may be damaged.
SYSTOLIC OVER	Systolic value is outside the measurable range.
NIBP MEAS TIME-OUT	The measuring time exceeded the specified time.

Other Alarms

Alarm Name	Description
LOW BATTERY	Battery is getting weak.

Messages

The following messages are monitoring information and are not considered alarms.

ECG Related Messages

Message	Description
ECG NOISE	Too much noise on the ECG waveform.

Respiration Related Messages

Message	Description
RESP NOISE	Too much noise on the respiration waveform.
RESP OFF	Respiration monitoring is turned off.

SpO_2 Related Messages

Message	Description
SpO2 CHECK PROBE SITE	The probe is not attached to the appropriate site or the probe is damaged.
SpO2 WEAK PULSE	Poor peripheral circulation.
SpO2 SEARCHING PULSE	Auto gain control is being done. When the message is displayed for more than 20 seconds, the detected pulse is too small to measure.
M (highlighted)	Pulse waveform is not stable.

NIBP Related Messages

Message	Description
NIBP RE-MEASURING	Remeasuring NIBP.
NIBP ZEROING	NIBP zero balance adjustment is performed.
NIBP NOISE	Noise detected during NIBP measurement.
NIBP WEAK PULSE	Patient's pulse is small.
INFLATION PRESS LOW	Insufficient cuff inflation pressure.
HIGH CUFF PRESS	Excessive pressure is applied by the cuff.

Other Messages

Message	Description
OUT OF PAPER	No recording paper.
RECORDER DOOR OPEN	Recorder door is open.

Alarm Indications

Overview

The monitor can indicate alarms both visually and audibly.

- Alarm sound
- Alarm message or highlighted numeric data on the screen
- Alarm indicator: red or yellow lamp

Alarm control marks indicating that various alarm functions are turned off are also displayed.

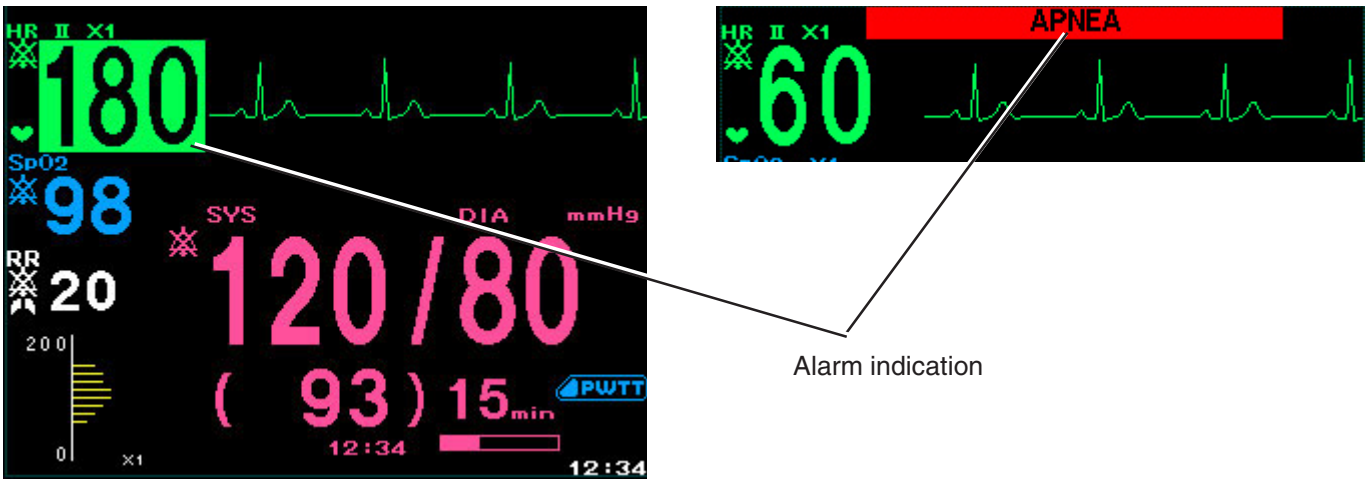
The alarm indicator indicates three alarm levels: crisis, warning and advisory. The red or yellow lamp blinks according to the alarm level.

CRISIS: Red blinks
WARNING: Yellow blinks
ADVISORY: Yellow lit

Individual Alarm Indications

Vital Signs Alarms

Alarm indication example

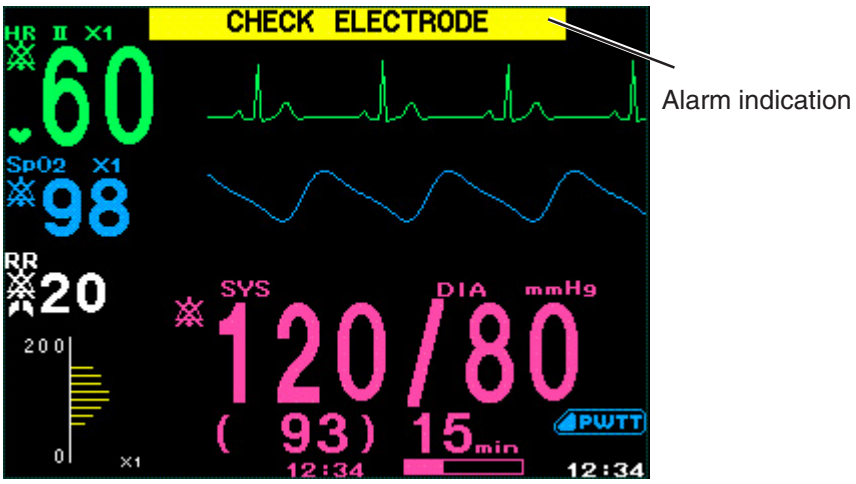


The APNEA alarm level can be set to either CRISIS or WARNING on the SYSTEM SETUP screen. Refer to Section 3.

Alarm	Alarm level	Alarm sound	Alarm display	Sound/display duration	Alarm indicator LED
APNEA	CRISIS	Continuous “pips”	“APNEA” message highlighted in red	During detection	Red
	WARNING	Continuous “bing bongs”	“APNEA” message highlighted in orange		Yellow
HR/PR	WARNING	Continuous “bing bongs”	Highlighted numeric data	During detection	Yellow
SpO_2					
NIBP SYS					
RR					

Parameter Alarms

Alarm indication example



ECG/Respiration related alarms

When the SILENCE ALARM key is pressed during these alarms, the alarm sound and lamp indication stops and the heart rate or respiration rate data disappears from the screen.

Alarm	Alarm level	Alarm sound	Alarm display	Sound/display duration	Alarm indicator LED
CHECK ELECTRODE ECG CONNECTOR OFF	ADVISORY	One “bong” at an interval set at ALARM FREQUENCY (ADVISORY) on the SYSTEM SETUP screen.	Message highlighted in yellow	During detection	Yellow

SpO_2 related alarms

Alarm	Alarm level	Alarm sound	Alarm display	Sound/ display duration	Alarm indicator LED
SpO2 PROBE FAULT SpO2 MODULE FAILURE	WARNING	Continuous “bing bongs”	Message highlighted in yellow	During detection	Yellow blinks
SpO2 LIGHT INTERFERENCE* SpO2 NO PROBE** SpO2 CHECK PROBE* SpO2 CANNOT DETECT PULSE*	ADVISORY	One “bong” at an interval set at ALARM FREQUENCY (ADVISORY) on the SYSTEM SETUP screen.	Message highlighted in yellow	During detection	Yellow lit

* When the SILENCE ALARM key is pressed during these alarms, the alarm sound and lamp indication stop and the message color changes from highlighted yellow to white.

** When the SILENCE ALARM key is pressed during this alarm, the alarm sound and lamp indication stops and the SpO_2 numeric data disappears from the screen.

NIBP related alarms

Alarm	Alarm level	Alarm sound	Alarm display	Sound/display duration	Alarm indicator LED
NIBP SAFETY VALVE OPEN NIBP CHECK INTERVAL NIBP HARDWARE ERROR NIBP NO PULSE* AIR HOSE OFF** CUFF OCCLUSION AIR LEAK* SYSTOLIC OVER* NIBP MEAS TIME-OUT*	ADVISORY	One “bong” at an interval set at ALARM FREQUENCY (ADVISORY) on the SYSTEM SETUP screen.	Message highlighted in yellow	During detection	Yellow lit

* When the SILENCE ALARM key is pressed during these alarms, the alarm sound and lamp indication stop and the message disappears.

** When the SILENCE ALARM key is pressed during this alarm, the alarm sound and lamp indication stops and the NIBP data disappears from the screen.

Other Alarms

Alarm	Alarm level	Alarm sound	Alarm display	Sound/ display duration	Alarm indicator LED
LOW BATTERY	WARNING	Continuous “bing bongs”	Message highlighted in yellow	During detection	Yellow blinks

Alarm Control Marks

When certain alarm functions are not available, an alarm control mark is displayed on the screen.

Alarm Silence Mark

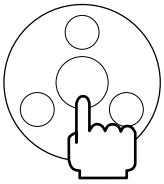
Remaining minutes is indicated beside the bell.

Individual Vital Signs Alarm Setting Indication

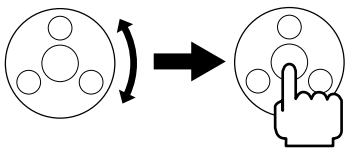
The ⛌ vital signs alarm off mark is displayed at every parameter which has the vital signs alarm limit set to OFF.

Adjusting the Alarm Sound Volume

The alarm sound volume can be adjusted on the REC/SOUND window. At the lowest setting, the alarm sound is still audible.



1. From the monitoring screen, press the rotary dial center key on the front panel. The ALARM window opens.



2. Turn the rotary dial to select “REC/SOUND” and press the rotary dial center key to enter the REC/SOUND window. The cursor moves to the “REC SPEED” box.

3. Turn the rotary dial to select “ALARM”, press the rotary dial center key to change the cursor color to blue, turn the rotary dial to select the appropriate alarm volume, and press the rotary dial center key to register the volume.

4. To return to the monitoring screen, select “CLOSE” on the REC/SOUND window or press the HOME/REVIEW key on the front panel.

Temporarily Silencing/Suspending Alarms

Overview

When an alarm occurs, you can silence the alarm sound and indications for two minutes. When an alarm, except for NIBP systolic alarm, is silenced, the alarm resumes after the alarm silence ends. When an NIBP systolic alarm is silenced, the alarm sound and indication lamp do not resume after the alarm silence ends and only the numeric data is highlighted. When several alarms occur together and the SILENCE ALARM key is pressed, all alarms are silenced.

An alarm can also be suspended before it occurs, for example, before you replace the electrodes. The alarm suspend time is two minutes.

Silencing an Alarm After Alarm Occurrence

During alarm silence,

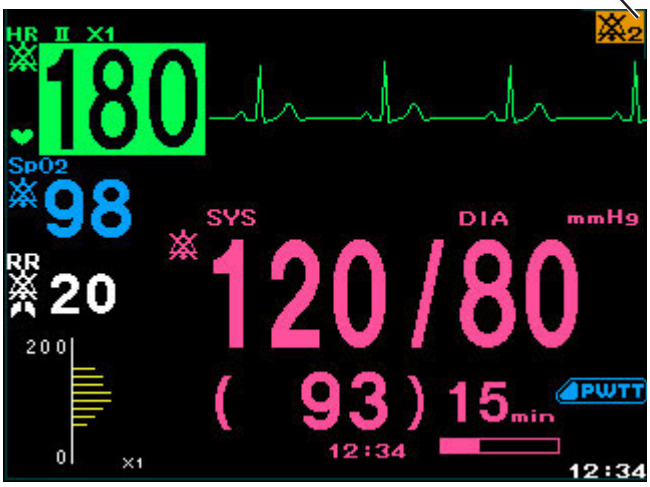
- the suspended mark and the remaining minutes are displayed
- the alarm sound is silenced.

If another alarm occurs during alarm silence, the alarm sound, indication and recording occur as usual. The alarm silence does not affect alarms which occur after the SILENCE ALARM key is pressed. (A new occurrence of the silenced alarm condition is treated as a different alarm.) When this alarm is silenced, the alarm silence time is reset.

Silencing an Alarm

Press the SILENCE ALARM key on the front panel. The alarm silenced mark with the minutes remaining in the alarm silence are displayed on the screen.

The alarm silenced mark with the minutes remaining in the alarm silence



Canceling an Alarm Silence

Vital sign alarm silence can be cancelled by pressing the SILENCE ALARM key. The alarm silence mark disappears and all alarms are resumed. Parameter alarm and other alarm silence cannot be cancelled.

Suspending an Alarm Before Alarm Occurrence

During alarm suspension, all alarms are suspended and

- the alarm silenced mark with the remaining suspension time is displayed
- the alarm sound is silenced.

The alarm suspend time is 2 minutes.

WARNING

All alarms are suspended during two minutes alarm suspension.

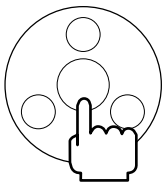
Turning Automatic Alarm Recording On/Off

Alarm recording is available only when the optional RG-101W recorder unit is installed in the monitor.

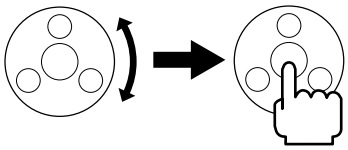
If ALARM REC on the REC/SOUND window is set to ON, monitoring waveforms beginning 4 seconds before and ending 11 seconds after the alarm are automatically recorded with numeric data at 25 mm/s recording speed when a vital sign alarm is generated. If this setting is OFF, the data are not automatically recorded when an alarm occurs. You can still record data manually.

To cancel recording while an automatic vital signs alarm is being recorded, press the record key on the front panel.

To set automatic vital signs alarm recording on or off:



1. From the monitoring screen, press the rotary dial center key on the front panel. The ALARM window opens.



2. Turn the rotary dial to select “REC/SOUND” and press the rotary dial center key to enter the REC/SOUND window. The cursor moves to the “REC SPEED” box.

3. Turn the rotary dial to select “ALARM REC” and press the rotary dial center key to select ON or OFF.

4. To return to the monitoring screen, select “CLOSE” on the REC/SOUND window or press the HOME/REVIEW key on the front panel.

Setting Alarm

Overview

Set all alarm limits on the ALARM window.

When SAVE ALARM SETUP on the SYSTEM SETUP screen is set to:
ON: The alarm setting remains in memory after power off.
OFF: The alarm setting returns to the factory default settings 30 minutes after the monitor power off. The red diamond marks are displayed in front of the parameter label on the ALARM window.

To set NIBP alarm limits for neonate, the cuff for neonates must be connected to the cuff socket on the monitor.

Alarm Limits Ranges

The following table shows the setting ranges for each alarm. Any upper and lower limit can also be set to off.

Parameter	Upper limit (Default setting)	Lower limit (Default setting)	Step
NIBP adult (mmHg/kPa)*	15 to 260, OFF (180) mmHg 1.5 to 35.0, OFF (24.0) kPa	OFF, 10 to 255 (80) mmHg OFF, 1.0 to 34.5 (10.5) kPa	5 mmHg 0.5 kPa
NIBP neonate (mmHg/kPa)*	10 to 125, OFF (100) mmHg 1.5 to 17.0, OFF (13.5) kPa	OFF, 5 to 120 (50) mmHg OFF, 1.0 to 16.5 (5.5) kPa	5 mmHg 0.5 kPa
HR/PR (beats/min)	20 to 300, OFF (140)	OFF, 15 to 295 (40)	5
SpO2 (%)	51 to 100, OFF (OFF)	OFF, 50 to 99 (90)	1
RR (breaths/min)	2 to 150, OFF (OFF)	OFF, 0 to 148 (OFF)	2
Apnea (s)	5 to 40, OFF (OFF)	—	5

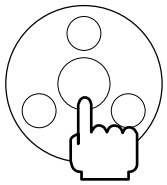
* The NIBP unit can set on the SYSTEM SETUP screen. Refer to Section 3.

Setting Vital Signs Alarm Limits

CAUTION

When the alarm limit is set to OFF, there will be no alarm for that limit.

If the upper limit is set to a value above the maximum, or the lower limit is set to a value below the minimum, the alarm for that upper/lower limit is automatically set to OFF.



1. From the monitoring screen, press the rotary dial center key on the front panel. The ALARM window opens.

2. Press the rotary dial center key to enter the ALARM window. The cursor moves to the “SYS” upper box.

3. Press the rotary dial center key to change the cursor color to blue, turn the rotary dial to select the limit for that parameter, and press the rotary dial center key to register the setting.

4. To set an alarm for another parameter, turn the rotary dial to move the cursor to that limit box, press the rotary dial center key to change the cursor color to blue, turn the rotary dial to select the limit for that parameter, and press the rotary dial center key to register the setting.

5. To return to the monitoring screen, select “CLOSE” on the REC/SOUND window or press the HOME/REVIEW key on the front panel.

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This section explains how to monitor the patient's waveforms and data.

Before monitoring the patient:

- Prepare the patient and equipment according to Sections 2 to 4, 7 to 10. When using a recorder unit, also see Section 6.
- Before monitoring a new patient, follow the flowchart in Section 2.
- Read the safety precautions in the "Safety Precautions for Monitoring" section.

In this section:

- "Overview" gives general information for all monitoring.
- "Using Sleep Mode" explains how to use sleep mode.
- "List Window" and "Trendgraph Window" sections explain about the list window and trendgraph window, respectively.

Safety Precautions for Monitoring

Before beginning monitoring, observe the following safety precautions and the safety precautions in Sections 7 to 10 for ECG and other monitored parameters.

Using an Electrosurgery Unit

WARNING

- **Electrosurgical units (ESU) emit a lot of RF interference. If the monitor is used with an ESU, RF interference may affect the monitor operation.**
- **Locate the monitor as far as possible from the ESU. Locate them on opposite sides of the operating table, if possible.**
- **Connect the monitor and ESU to different AC outlets located as far as possible from each other.**
- **When using this monitor with an electrosurgical unit, its return plate and the electrodes for monitoring must be firmly attached to the patient. If the return plate is not attached correctly, it may burn the patient's skin where the electrodes are attached.**

Using a Defibrillator

WARNING

To avoid the risk of serious electrical burn, shock, or other injury during defibrillation, all persons must keep clear of the bed and must not touch the patient or any equipment connected to the patient.

If the ECG waveform on the screen is too unstable to synchronize with the patient's heart beat because of the following reason(s), remove the cause(s) of an alarm, message, or unstable ECG, and then use a stable ECG lead for synchronization.

- ECG electrode is detached or broken. Lead wire is detached or broken.
- Lead wire moves. AC interference, EMG noise or noise from ESU is superimposed.
- Connection cable is broken or has a short circuit. Connector has poor contact.

Overview

Monitoring Screen

When you first begin monitoring, a monitoring screen appears. The monitoring screen displays waveforms and numeric data for monitoring parameters. Any time you press the HOME/REVIEW key on the front panel, the monitoring screen appears.

The parameters on the monitoring screen depend on the measured parameters.

Review Windows

NOTE

The stored data remains in memory for about 30 minutes after the monitor power is turned off. After 30 minutes, the stored data is lost.

The list and trendgraph windows display the stored data. You can display the list of up to 400 vital signs data on the list window and a trendgraph with 30 min, 1, 2, 4, 8 or 24 hour trend time on the trendgraph window.

For details about the review windows, refer to the “List Window” and “Trendgraph Window” sections.

Sync Sound

During monitoring, a continuous “pip” sounds in synchronization with either the QRS or SpO_2 pulse. QRS is the default setting. Refer to “Changing the Sync Source” in Section 7 or 9 to change the source of the sync sound.

Adjusting the Sync Sound Volume

The sync sound volume can be adjusted on the REC/SOUND window. At the lowest setting, the sync sound is not audible. Refer to the “Changing the Sync Sound Volume” section.

Changing Settings and Performing Other Tasks During Monitoring

Every screen except the SYSTEM SETUP screen always displays the monitoring parameter data. This lets you monitor the patient continuously without interruption while you do other tasks, such as changing settings, recording or viewing trendgraphs.

Monitoring Screen

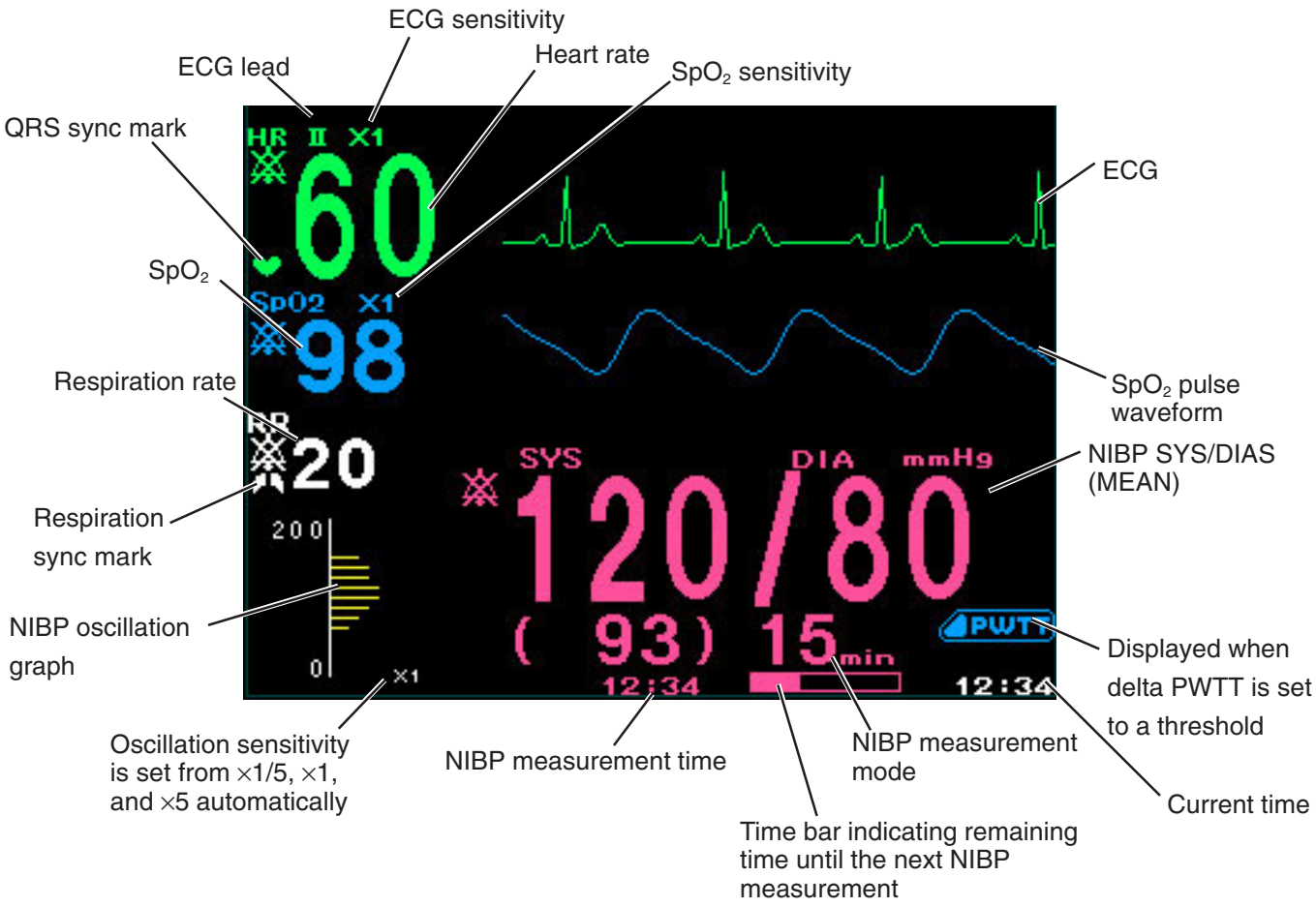
When you first begin monitoring, a monitoring screen appears.

The monitoring screen is automatically laid out according to the measured parameters. The layout changes when a parameter connection cord is connected or disconnected.

The settings for monitoring parameters can be changed on the setup windows. For details about individual parameters, see Sections 7 to 10.

Up to two waveforms can be displayed on the monitoring screen. To select the displayed waveforms, refer to the "Changing Displayed Waveforms on the Monitoring Screen" section.

When monitoring ECG, impedance respiration, SpO_2 and NIBP



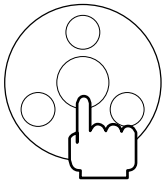
The size of the NIBP display depends on the number of displayed waveforms.

Changing Displayed Waveforms on the Monitoring Screen

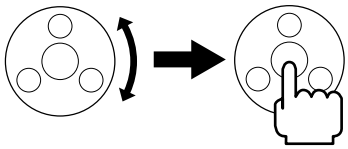
Up to two waveforms can be displayed on the monitoring screen. The displayed waveforms can be changed on the OTHER window of the setup window.

When a setup window or review window is displayed, only the waveform set for the upper wave is displayed on the screen.

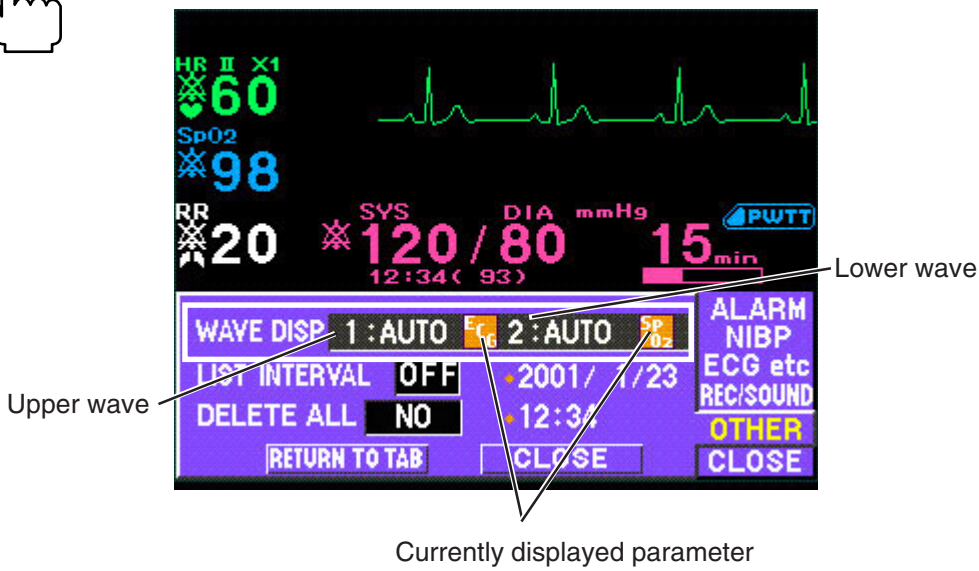
To change the displayed waveform parameters:



1. From the monitoring screen, press the rotary dial center key on the front panel. The ALARM window opens.



2. Turn the rotary dial to select “OTHER” and press the rotary dial center key to enter the OTHER window. The cursor moves to the “WAVE DISP” box.



3. Press the rotary dial center key to change the cursor color to blue and turn the rotary dial to select waveforms. The parameters change in the following order.

   1: AUTO/2: AUTO → 1: AUTO/2: OFF → 1: ECG/2: ECG → 1: ECG/2: SpO2 → 1: ECG/2: RESP → 1: SpO2/2: RESP → 1: ECG/2: OFF → 1: SpO2/2: OFF → 1: RESP/2: OFF → 1: OFF/2: OFF

   When “AUTO” is selected, the actual waveform is selected in the following priority.

   ECG > SpO_2 > RESP

When ECG is selected for both waveforms, ECG is displayed cascaded.

When respiration monitoring is turned off, there is no respiration waveform display.

4. Press the rotary dial center key to register the selected setting.

5. To return to the monitoring screen, select “CLOSE” on the OTHER window or press the HOME/REVIEW key on the front panel.

Using Sleep Mode

In sleep mode, the screen is darkened and sync sound is turned off.

Use this mode when you want to prevent the monitor from disturbing the patient, such as during sleep.

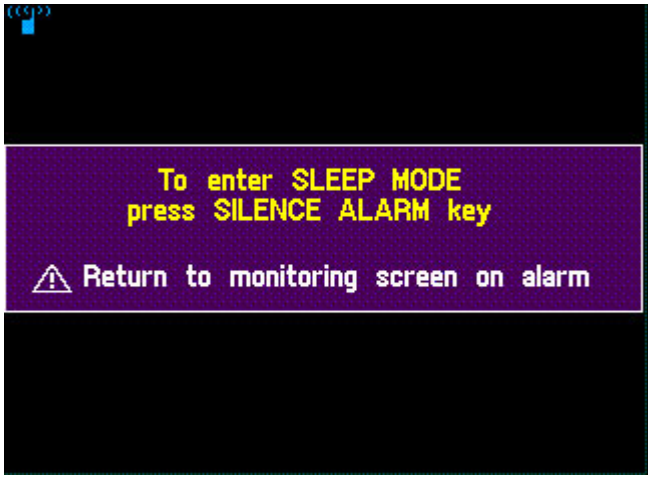
When EXIT SLEEP MODE ON ALARM on the SYSTEM SETUP screen is set to:
YES: Sleep mode is turned off and the monitoring screen appears when an alarm occurs.
NO: Sleep mode continues even when an alarm occurs.
Refer to Section 3.

WARNING

When EXIT SLEEP MODE ON ALARM is set to NO, the bedside monitor alarm cannot be seen or heard on the bedside monitor during sleep mode. Attach the transmitter (optional) to the monitor and monitor the bedside monitor alarm on the central monitor or telemetry system. Otherwise, bedside monitor alarms may be overlooked.

Turning Sleep Mode On

1. Press the HOME/REVIEW key on the front panel several times until the sleep mode confirmation window is displayed.

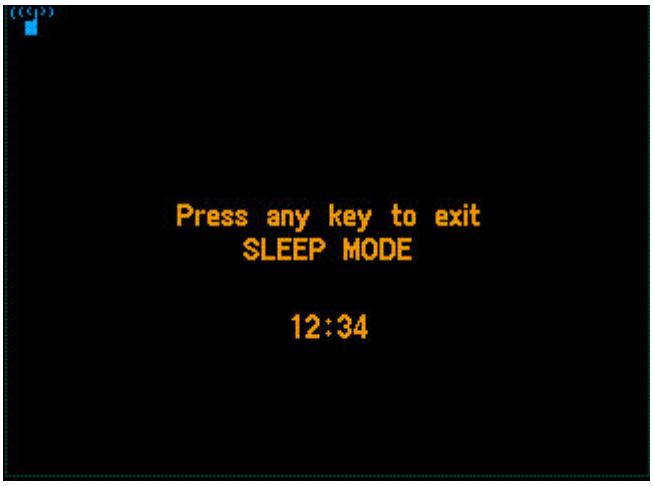


The above screen is when EXIT SLEEP MODE ON ALARM is set to YES.

When there is no key operation for one minute, the screen returns to the monitoring screen.

2. Press the SILENCE ALARM key to set the sleep mode.

During sleep mode, the following screen is displayed.



Turning Sleep Mode Off

Press any hard key on the front panel except for the power key.

List Window

Overview

The list window lists all parameter data that is measured and saved at NIBP measurement and preset intervals. The list can be recorded on the optional recorder unit. List parameters are:

- NIBP
- Heart rate/pulse rate
- SpO_2
- Respiration rate
- MEMO

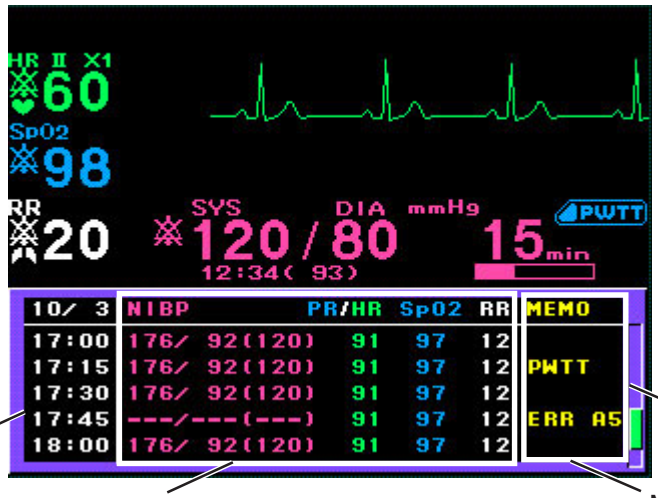
One window shows 5 measurements (one page). Each measurement appears on a separate line. Up to 400 measurements can be stored in memory. If more than 400 measurements are made, the oldest measurement is deleted.

NOTE

The stored data remains in memory for about 30 minutes after the monitor power is turned off. After 30 minutes, the stored data is lost.

Displaying the List Window

From the monitoring screen, press the HOME/REVIEW key. The list window is displayed at the lower part of the screen.



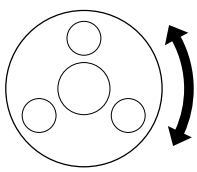
Data acquired time
The acquisition time of the data with NIBP is the NIBP measurement starting time.

Parameter data

Scroll bar

Memo
Information about the acquired data

You can select whether the oldest data or the latest data is at the top of the list on the SYSTEM SETUP screen (LIST SORTING). Refer to Section 3.



To scroll the data, turn the rotary dial.
Clockwise: scrolls downwards
Counterclockwise: scrolls upwards

To return to the monitoring screen, press the HOME/REVIEW key several times until the monitoring screen is displayed.

MEMO

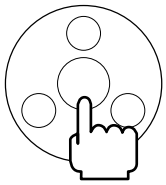
The following table explains the codes in the MEMO column.

MEMO code	Description
ERR A1	"NIBP HARDWARE ERROR" error occurred
ERR A2	"NIBP SAFETY VALVE OPEN" error occurred
ERR A3	"CUFF OCCLUSION" error occurred
ERR A4	"NIBP MEAS TIME-OUT" error occurred
ERR A5	"AIR LEAK" error occurred
ERR A6	"NIBP NO PULSE" error occurred
ERR A7	"SYSTOLIC OVER" error occurred
ERR A8	"AIR HOSE OFF" error occurred
ERR A9	"HIGH CUFF PRESS" error occurred
ERR I1	"NIBP NOISE" error occurred
ERR I2	"NIBP WEAK PULSE" error occurred
PWTT	NIBP measured triggered by PWTT
SYS, HR/PR, SpO2, RR, APNEA	NIBP measured at vital alarm occurrence
TIME	List data acquired at set list interval

When the code with "ERR" is displayed, NIBP is not measured and "---/---(---)" is displayed for NIBP data. For details about the alarm messages, refer to Section 11 "Error Messages and Troubleshooting".

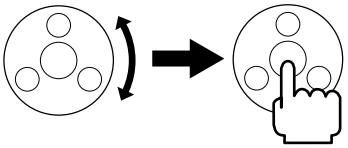
Setting the Data Sampling Interval

Usually, the list data is acquired at NIBP measurement. When the list interval is set, the data can also be acquired at the set intervals.



To set the list sampling interval:

1. From the monitoring screen, press the rotary dial center key on the front panel. The ALARM window opens.



2. Turn the rotary dial to select “OTHER” and press the rotary dial center key to enter the OTHER window. The cursor moves to the “WAVE DISP” box.

3. Turn the rotary dial to select “LIST INTERVAL”, press the rotary dial center key to change the cursor color to blue, turn the rotary dial to select interval and press the rotary dial center key to register the selected interval.

   Select the interval from OFF, 1 min, 5 min, 15 min, 30 min and 60 min. When OFF is set, the list data is acquired only at NIBP measurement.

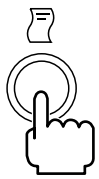
4. To return to the monitoring screen, select “CLOSE” on the OTHER window or press the HOME/REVIEW key on the front panel.

Recording the List

The list data can be recorded when the optional RG-101W recorder unit is installed in the monitor.

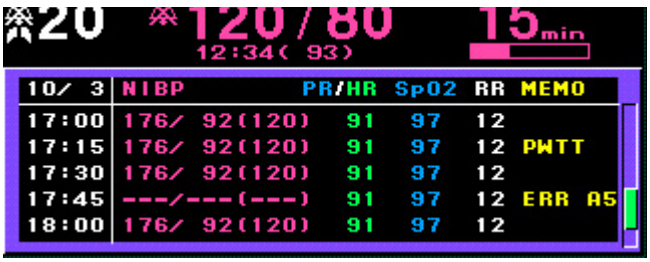
The following list recordings are available.

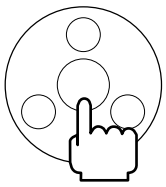
- Record displayed list data (up to 5 data)
- Record all list data
- Record list data every time the list data is acquired



Recording the Displayed or All List Data

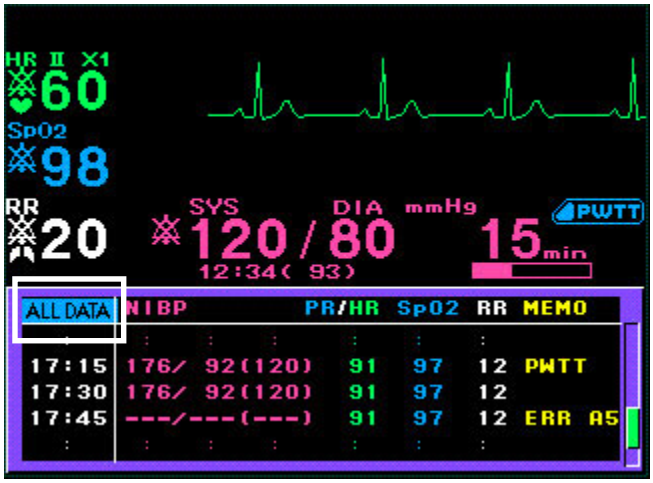
On the list window, display the data you want to record, then press the record key on the front panel.





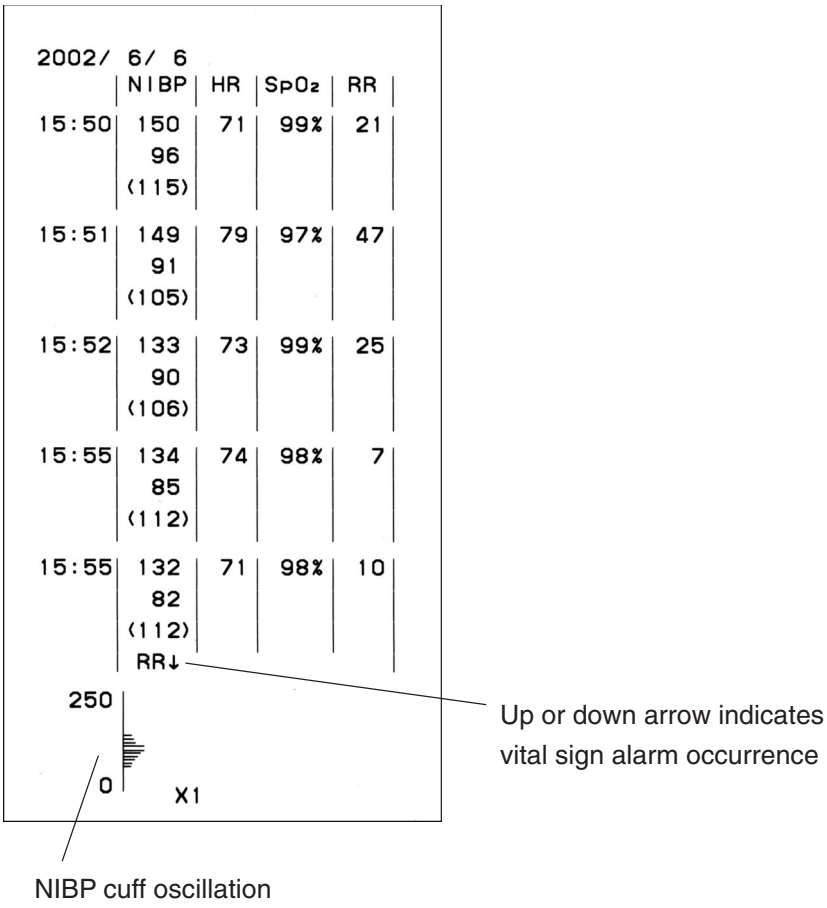
To record all saved list data:

1. Press the rotary dial center key on the list window. The “ALL DATA” appears in the date column.



2. Press the record key. All saved list data is recorded.

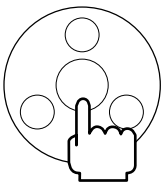
Recording example



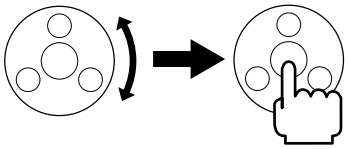
Auto List Recording

When AUTO LIST REC on the REC/SOUND window is set to ON, the newly listed data can be automatically recorded on acquisition.

To set auto list recording to on:



1. From the monitoring screen, press the rotary dial center key on the front panel. The ALARM window opens.



2. Turn the rotary dial to select “REC/SOUND” and press the rotary dial center key to enter the REC/SOUND window. The cursor moves to the “REC SPEED” box.

3. Turn the rotary dial to select “AUTO LIST REC” and press the rotary dial center key to select ON or OFF.

4. To return to the monitoring screen, select “CLOSE” on the REC/SOUND window or press the HOME/REVIEW key on the front panel.

Trendgraph Window

Overview

On the trendgraph window, a monitoring parameter trendgraph is displayed with 30 min, 1, 2, 4, 8 or 24 hour trend time. You can record the trendgraph on the optional recorder unit.

NOTE

The stored data remains in memory for about 30 minutes after the monitor power is turned off. After 30 minutes, the stored data is lost.

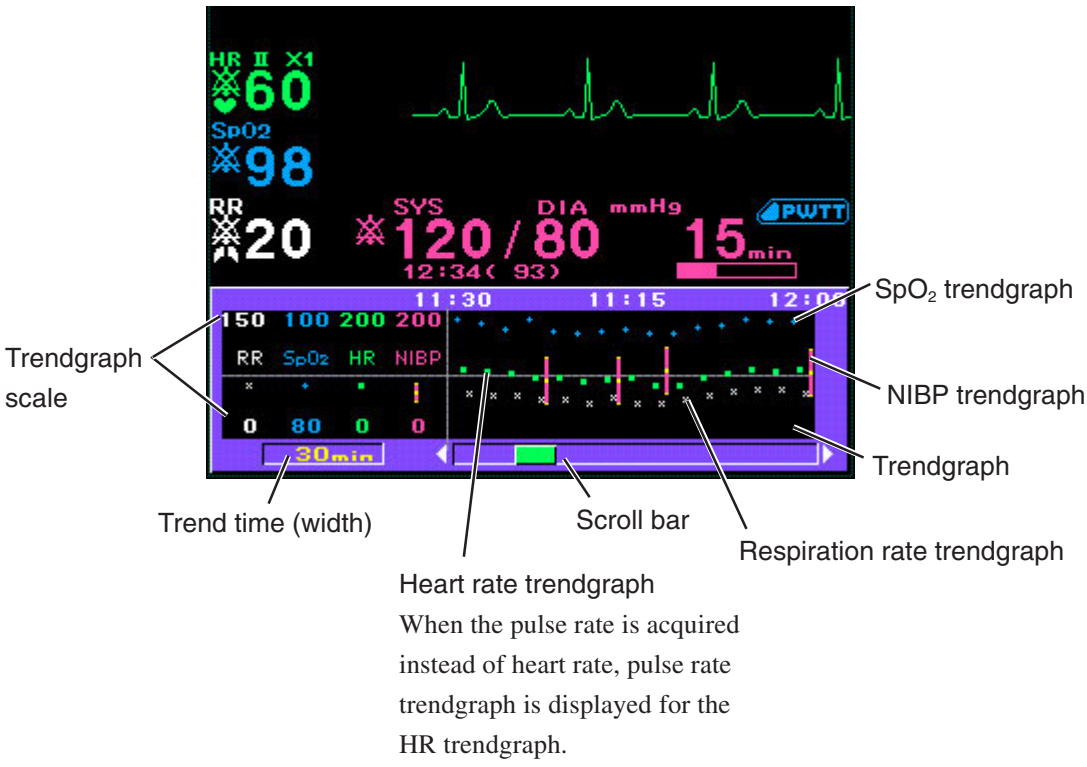
The frequency of data display and recording depends on the selected trend time.

Trend time	Frequency of data display	Frequency of data recording
30 min	2 min	1 min
1 hour	4 min	2 min
2 hours	8 min	4 min
4 hours	16 min	8 min
8 hours	32 min	16 min
24 hours	96 min	48 min

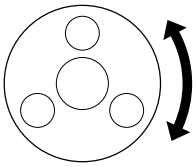
The trendgraphs are drawn from the data acquired for the list window (maximum of 400 data). Therefore, when the list interval is set to 15 minutes and the trend time is set to 30 minutes, only three data are displayed on the trendgraph window. When the trend time is set to a long time, the left side of the trendgraph may appear blank because there is no list data.

Displaying the Trendgraph Window

From the monitoring screen, press the HOME/REVIEW key twice. The trendgraph window is displayed at the lower part of the screen.



Trendgraph display can be set to off for each parameter by selecting OFF for the trendgraph scale. Refer to the “Changing the Trendgraph Scale” section.



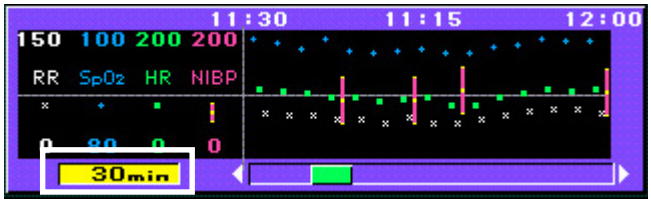
Scrolling the Trendgraph

Trendgraphs can be scrolled sideways with the rotary dial when the scroll bar is yellow.

To change the scroll bar color to yellow, press the rotary dial center key, turn the rotary dial to move the cursor to the scroll bar and press the rotary dial center key again. Then, turn the rotary dial to scroll the trendgraphs sideways.

Changing the Trendgraph Time Width

1. Press the rotary dial center key, turn the rotary dial to move the cursor to the trend time box (the trend time box is highlighted) and press the rotary dial center key again.



2. Turn the rotary dial to select the trend time width from 30 min, 1 hour, 2 hours, 4 hours, 8 hours and 24 hours and press the rotary dial center key to register the setting.

Changing the Trendgraph Scale

1. Press the rotary dial center key, turn the rotary dial to move the cursor to the scale (the selected scale is highlighted) and press the rotary dial center key again.

2. Turn the rotary dial to select the scale and press the rotary dial center key to register the setting.

   When OFF is selected, the parameter trendgraph is not displayed.

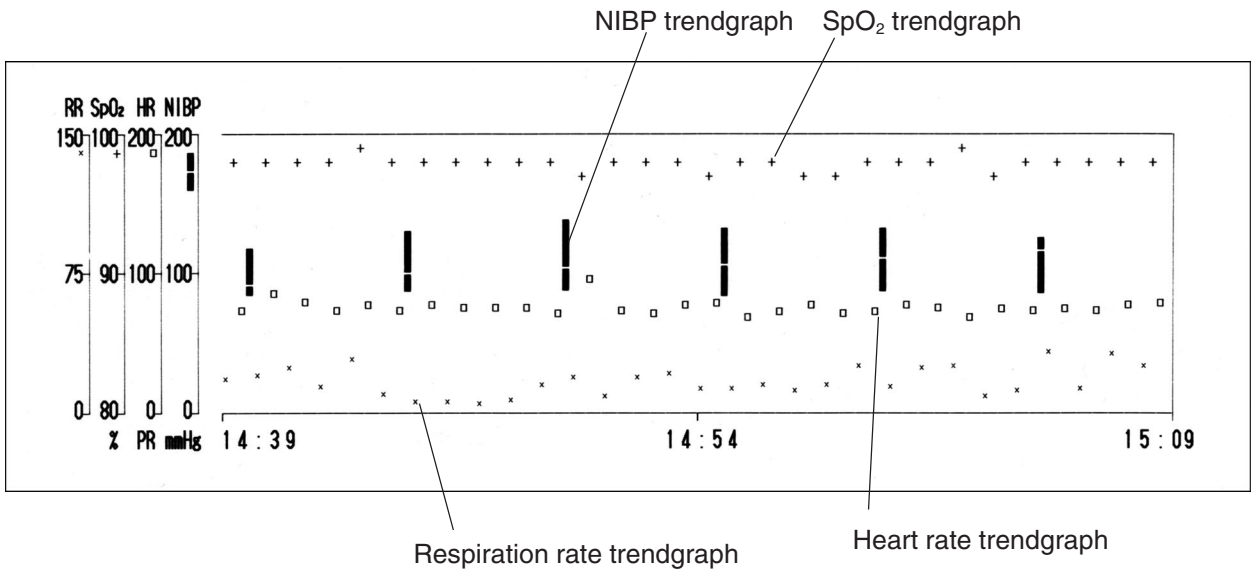
Parameter	Available Scales	Initial Setting
Respiration rate	0-50, 0-150, OFF (breaths/min)	0-50
SpO_2	0-100, 50-100, 80-100, OFF (%)	80-100
Heart rate/pulse rate	0-100, 0-200, 0-300, OFF (beats/min)	0-200
NIBP	0-100, 0-200, 0-300, OFF (mmHg)	0-200

Recording the Trendgraphs

The trendgraph data can be recorded when the optional RG-101W recorder unit is installed in the monitor.

On the trendgraph window, display the data you want to record, then press the record key on the front panel.

Recording example



Section 6 Recording

Overview of Recording 6.1
- Recording Modes 6.1
  - Manual Recording on the Monitoring Screen 6.2
  - Manually Recording on the List and Trendgraph Windows 6.2
  - Alarm Recording 6.2
- Recording Mode Annotations 6.3
- Recording Sensitivity 6.3
- Recording Speed 6.3
- Recording Related Messages 6.3
- Recorded Data 6.4

Changing the Recording Speed 6.5
Manually Recording Waveforms 6.6

Overview of Recording

Waveforms and data can be recorded on the optional RG-101W recorder unit.

Some recording procedures are explained in other sections.

- To record trendgraphs, see Section 5.
- To record the vital signs list, see Section 5.
- For alarm recording, see Section 4.

To load recording paper, see “Preparing the Optional Recorder Unit” in Section 2.

For what to do in case of trouble, see Section 11.

Recording Modes

The following recording modes are available.

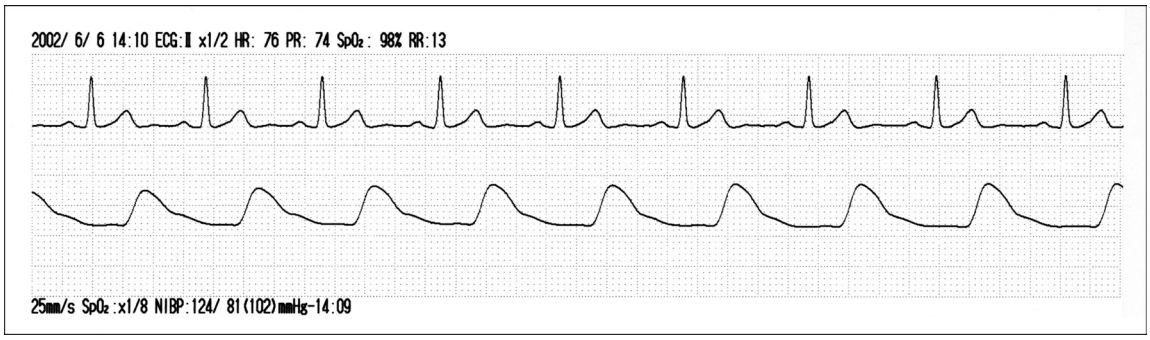
Recording mode		Recorded data	Length/time of recorded data	Operations/conditions/ settings for recording	Printed annotation
Manual recording	Waveform recording	Monitoring waveforms and vital sign data	Time set at REC DURATION on the SYSTEM SETUP screen	Record key on the front panel is pressed	MANUAL
				Recording duration on the SYSTEM SETUP screen. See Section 3.	
				Recording speed on the REC/SOUND window. See the “Changing the Recording Speed” section.	
	List recording	List on the window	Data displayed on the window or all saved data	Record key is pressed on the list window. To record all list data, “ALL DATA” must be displayed. See Section 5.	LIST
	Auto list recording	Acquired list data	—	AUTO LIST REC on the REC/SOUND window must be set to ON. See Section 5.	
	Trendgraph recording	Trendgraphs on the window	—	Record key is pressed on the trendgraph window	TREND
Alarm recording	Vital signs alarm recording	Monitoring waveforms and vital sign data at an alarm occurrence	From 4 seconds before to 11 seconds after alarm occurrence	ALARM REC on the REC/SOUND window must be set to ON. See Section 4.	ALARM
				Alarm for vital signs parameter must be turned on. See Section 4.	

Manual Recording on the Monitoring Screen

Monitoring waveforms and data on the monitoring screen are recorded whenever the record key on the front panel is pressed.

For details, refer to the “Manually Recording Waveforms” section.

Recording example



Manually Recording on the List and Trendgraph Windows

Data displayed on the review windows can be recorded. For details, refer to Section 5.

Alarm Recording

When a vital sign alarm occurs, monitoring waveforms and vital sign data are automatically recorded. The recorded waveforms are from 4 seconds before to 11 seconds after the alarm occurrence and are recorded at 25 mm/s recording speed.

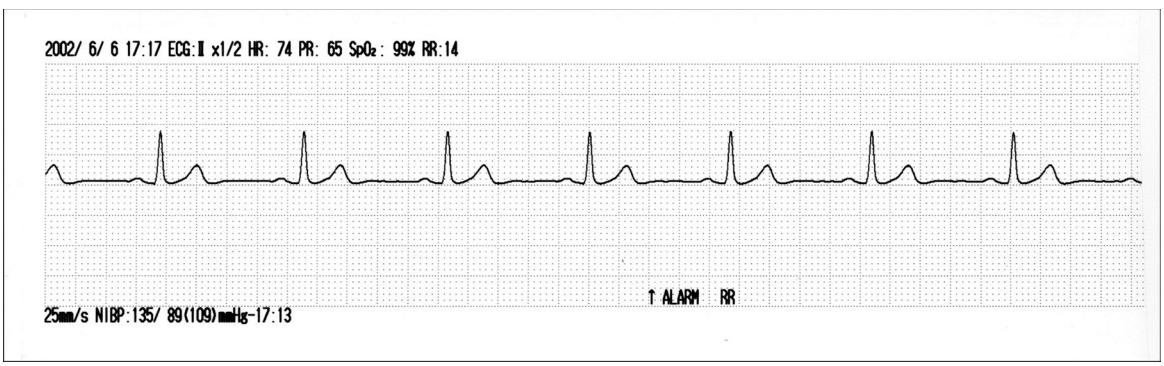
Set alarm recording on or off on the REC/SOUND window. For details, refer to Section 4.

CAUTION

Alarm recording is not performed when:

- **Vital sign alarms are set to OFF on the ALARM window.**
- **Alarm recording is set to Off.**

Recording example



Recording Mode Annotations

For the alarm recording, the “ALARM” annotation is printed on the recording paper.

Recording Sensitivity

The sensitivity of the waveforms recorded on the recording paper is the same as the sensitivity of the waveforms displayed on the screen.

To change the sensitivity, change the sensitivity of the parameter as described in Sections 7 to 10.

Recording Speed

The recording speed can be selected from 6.25, 12.5 and 25 mm/s for manual recording on the REC/SOUND window. Refer to the “Changing the Recording Speed” section.

Recording Related Messages

The following messages and icons appear in the following conditions.

During recording

When out of recording paper

The “OUT OF PAPER” message is displayed for 5 seconds at detection.

When the recorder door is open

The “RECORDER DOOR OPEN” message is displayed for 5 seconds at detection.

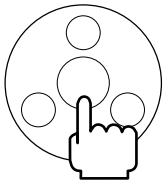
Recorded Data

The following data can be recorded.

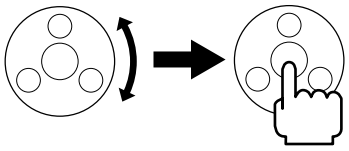
Printed Items	Example
Date and time of recording	2002/05/11 10:30
Reason for recording	ALARM etc.
Sensitivity	×2
Recording speed	25 mm/s
Heart rate (beats/min)	HR: 100
ECG lead	II
Pulse rate (beats/min)	PR: 80
SpO_2 (%)	SpO_2: 98
NIBP: SYS/DIA (MEAN) (mmHg), measurement time	NIBP: 132/61 (80) mmHg 17:24
Respiration rate (resp/min)	RR: 14

Changing the Recording Speed

The recording speed can be selected from 6.25, 12.5, 25 mm/s for manual recording.



1. From the monitoring screen, press the rotary dial center key on the front panel. The ALARM window opens.



2. Turn the rotary dial to select “REC/SOUND” and press the rotary dial center key to enter the REC/SOUND window. The cursor moves to the “REC SPEED” box.

3. Press the rotary dial center key to change the cursor color to blue, turn the rotary dial to select the recording speed, and press the rotary dial center key to register the speed.

4. To return to the monitoring screen, select “CLOSE” on the REC/SOUND window or press the HOME/REVIEW key on the front panel.

Manually Recording Waveforms

Waveforms and data can be recorded manually on the optional RG-101W recorder unit.

There are two settings:

- Recording length: 7.5, 15, 30 or 60 seconds* can be selected for the recording length on the SYSTEM SETUP screen. Refer to Section 3.
  * These durations are when the recording speed is at 25 mm/s. When the recording speed is 12.5 mm/s, the duration is doubled, and when the recording speed is 6.25 mm/s, the duration is four times that of 25 mm/s.
- Recording speed: 6.25, 12.5, 25 mm/s can be selected for the recording speed. Refer to the “Changing the Recording Speed” section.

Press the record key on the front panel. The waveforms 4 seconds before the key is pressed is recorded with the numeric data.

To stop recording, press the record key again.

Section 7 ECG Monitoring

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- Preparation Flowchart 7.2
- Electrode Position 7.2
  - Electrode Position 7.2
  - Lead Connection 7.2
- Selecting Electrodes and Lead 7.3
  - Types of Electrodes and Leads 7.3
- Connecting Cables and Attaching Disposable Electrodes 7.4
  - Connecting the Electrode Cable to the Monitor 7.4
  - Attaching Disposable Electrodes to the Patient 7.5

Monitoring ECG 7.6
- ECG Information on the Monitoring Screen 7.6
- Noise Detection and Display 7.7
- Detached Electrode Detection and Display 7.7

Changing ECG Settings 7.8
- Changing the Heart Rate or Pulse Rate Alarm Limits 7.8
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- Changing the ECG Sensitivity 7.11
- Turning Pacing Spike Detection On/Off 7.12
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Use with an Electrosurgical Unit 7.15

General

ECG is monitored by attaching 3 disposable electrodes to the patient and using the ECG/RESP socket on the monitor. Heart rate and ECG waveform are displayed on the screen. The monitoring lead can be selected from I, II and III.

WARNING

Interaction Between Minute Ventilation Rate-Adaptive Pacemakers and Cardiac Monitoring and Diagnostic Equipment*

The bioelectric impedance measurement sensor of a minute ventilation rate-adaptive implantable pacemaker may be affected by cardiac monitoring and diagnostic equipment which is connected to the same patient. If this occurs, the pacemaker may pace at its maximum rate and give incorrect data to the monitor or diagnostic equipment. If this occurs, disconnect the monitor or diagnostic equipment from the patient or change the setting on the pacemaker by referring to the pacemaker's manual. For more details, contact your pacemaker distributor or Nihon Kohden distributor.

* Minute ventilation is sensed in rate-adaptive pacemakers by a technology known as bioelectric impedance measurement (BIM). Many medical devices in addition to pacemakers use this technology. When one of these devices is used on a patient with an active, minute ventilation rate-adaptive pacemaker, the pacemaker may erroneously interpret the mixture of BIM signals created in the patient, resulting in an elevated pacing rate.

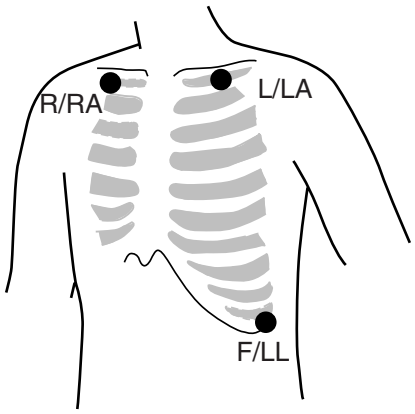
  For more information, see the FDA web site.
  http://www.fda.gov/cdrh/safety.html

Preparing for ECG Monitoring

Preparation Flowchart

1. Select the appropriate electrodes for the patient.
2. Connect the electrode lead to the ECG connection cord and connect the ECG connection cord to the ECG/RESP socket on the monitor.
3. Attach the disposable electrodes to the patient and attach the electrode lead to the electrodes.
4. Monitoring starts. Set necessary settings.
   For handling accessories after use, refer to Section 12.

Electrode Position

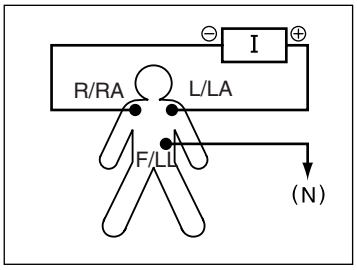


Electrode Position

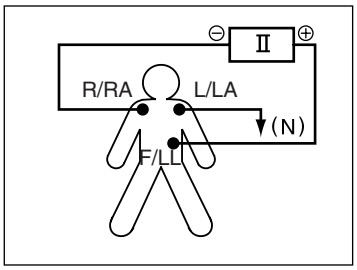
Symbol	Lead Color (Clip Color)	Electrode Position
R RA	Red (Red-beige) White (White-beige)	Right infraclavicular fossa
L LA	Yellow (Yellow-beige) Black (Black-beige)	Left infraclavicular fossa
F LL	Green (Green-beige) Red (Red-beige)	Lowest rib on the left anterior axillary line

Lead Connection

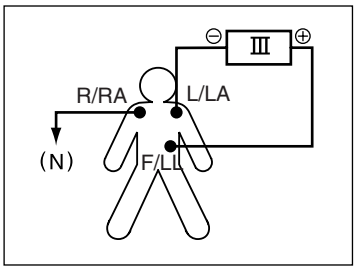
Lead I



Lead II



Lead III



(N) neutral

Selecting Electrodes and Lead

Select the appropriate electrodes and lead according to the purpose.

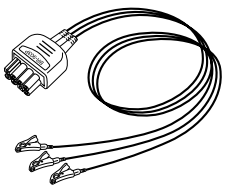
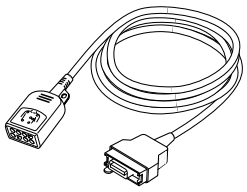
WARNING

When using a defibrillator together with the monitor, use Ag/AgCl electrodes. Other types of electrodes, stainless steel in particular, adversely affect the ECG waveform by slowing the baseline recovery on the monitor and result in no monitoring immediately following defibrillation.

CAUTION

- **Use only Nihon Kohden products and specified parts and accessories. When other type of electrodes are used, the "CHECK ELECTRODE" message may be displayed and monitoring may stop.**
- **Do not reuse disposable electrodes.**
- **When using the electrodes with DIN type lead, use only the Vitrode V or N electrodes. If other electrodes are used, the electrode lead may not be properly connected and ECG monitoring may be unstable.**

Types of Electrodes and Leads

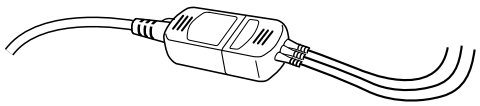
<table>
<tr><th>No. of Electrodes</th><th>Disposable Electrodes</th><th>Electrode Lead</th><th>ECG Connection Cord</th></tr>
<tr><td rowspan="2">3
(I, II, III)</td><td>Vitrode Bs-150*,
C-150, D-90*,
F-150M*,
F-150S*,
G-600, J-150</td><td>BR-903P (IEC)/BR-903PA (AHA) (Clip type)
BR-913P (IEC)/BR-913PA (AHA) (Snap type)
  </td><td rowspan="2">JC-103T (IEC)/JC-103TA (AHA)
  </td></tr>
<tr><td colspan="2">Disposable Electrode with DIN type lead, Vitrode V-090M3*, V-091O3*, V-120S3*, N-03IS3*</td></tr>
</table>

* These parts have not been checked for compliance with the MDD (Medical Device Directive). For EC member countries, Nihon Kohden recommends the use of parts that comply with MDD.

Connecting Cables and Attaching Disposable Electrodes

Connecting the Electrode Cable to the Monitor

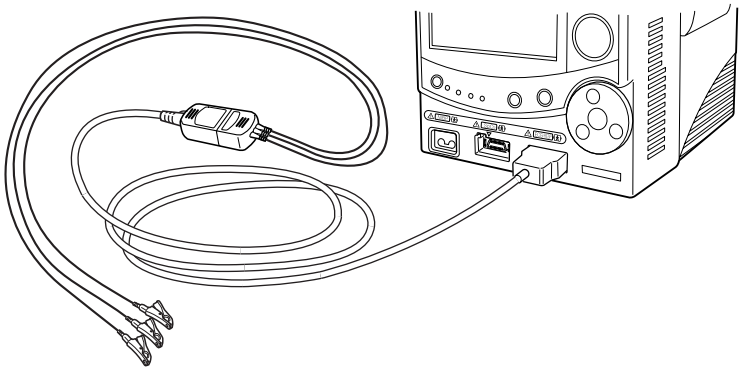
1. Connect the electrode lead and ECG connection cord so that their white panels face the same side.



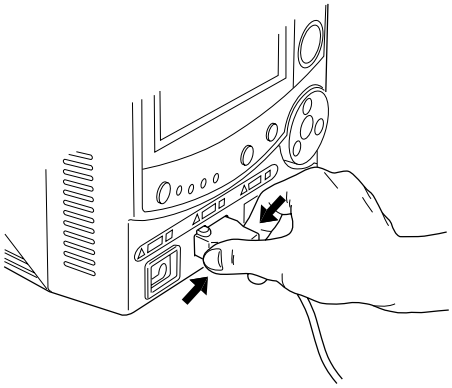
When using an electrode with a DIN type lead, connect the DIN type lead of the electrode directly to the ECG connection cord according to the panel symbols.

2. Connect the ECG connection cord to the ECG/RESP socket on the monitor.

When connecting the BR-903P 3-electrode lead



To disconnect the ECG connection cord from the monitor, press the buttons on both sides of the ECG connection cord connector and pull it out.



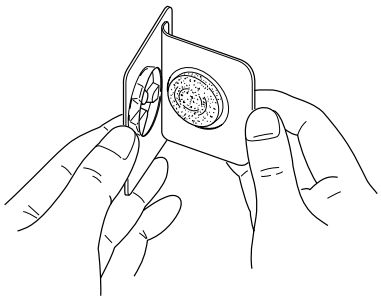
The SpO_2 connection cord is used as an example.

Attaching Disposable Electrodes to the Patient

NOTE

- **To maintain good contact between the electrode and skin, check that the paste of the disposable electrode is not dry.**
- **When contact of the disposable electrode becomes poor, replace the electrode with a new one immediately. Otherwise, contact impedance between the skin and electrode increases and the correct ECG cannot be obtained.**
- **If the contact is bad before the expiration date on the package, replace the electrode with a new one.**
- **To obtain a stable ECG waveform rub the skin with "skinPure" skin preparation gel or tincture of Benzoin.**

1. Shave excess hair. With a piece of cotton pad moistened with alcohol, clean the patient's skin where the electrodes should be mounted. Avoid wrinkled or uneven skin areas. Wipe off the alcohol with a dry cotton pad.

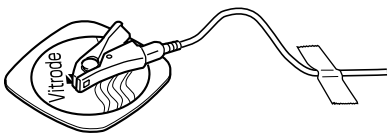


2. Open the electrode package and take out the electrode.

3. Remove the backing paper from the electrode. Be careful not to touch the adhesive side.

4. Attach the disposable electrode to the previously cleaned skin. Avoid wrinkled and uneven skin areas.

5. Clip the electrode lead which is connected to the monitor onto the electrode.



When using Vitrode V or N electrodes, there is no need to connect the electrode lead to the electrode.

6. Fasten the electrode lead to the skin with surgical tape with an extra length of wire between the tape and the electrode. This prevents body movement from moving the electrode lead.

Monitoring ECG

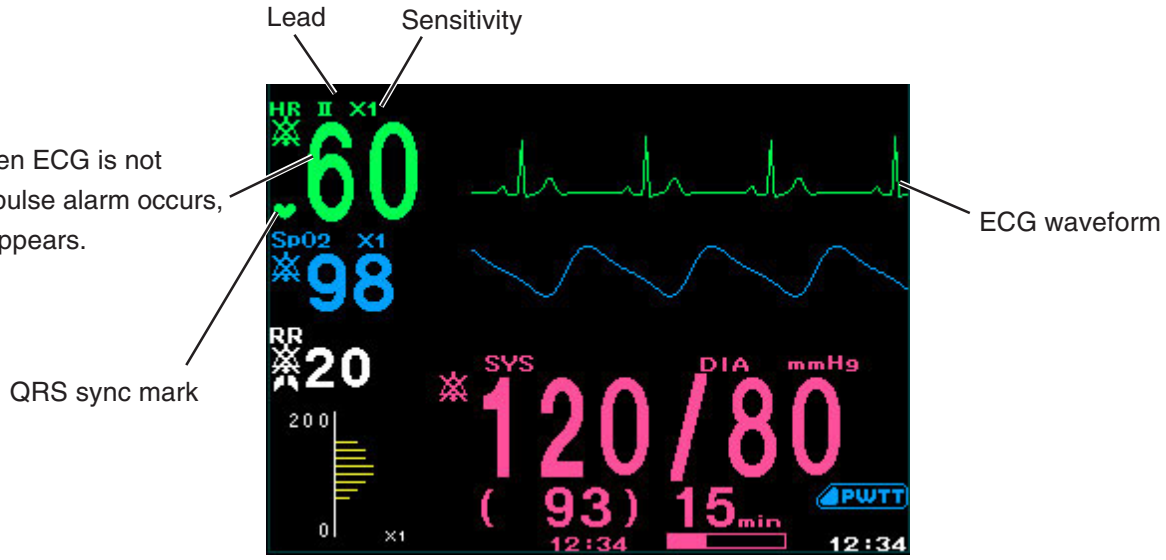
When electrodes are attached to the patient and the cables are connected properly, ECG appears on the screen.

CAUTION

When the "CHECK ELECTRODE" message is displayed, ECG cannot be monitored and the ECG alarm does not function. Check the electrodes, electrode leads and connection cord and if necessary, replace it with a new one.

For error messages and monitoring problems, refer to Section 11.

ECG Information on the Monitoring Screen



Noise Detection and Display

When EMG or body movement noise is superimposed on the ECG waveform during ECG monitoring, an “ECG NOISE” message appears on the screen.

Detached Electrode Detection and Display

When an electrode or electrode lead is detached during ECG monitoring, a “CHECK ELECTRODE” message appears with a “bong” sounding at an interval set on the SYSTEM SETUP screen (ALARM FREQUENCY on the ALARM SETUP). Refer to Section 3.

The correct ECG waveform does not appear on the screen while the “CHECK ELECTRODE” message is displayed. Check the electrodes.

Changing ECG Settings

The following settings can be changed for ECG monitoring.

Setting Item	Setting Screen
Heart rate alarm limits	HR/PR on the ALARM window.
Monitoring lead	ECG LEAD on the ECG etc window.
ECG sensitivity	ECG SENS on the ECG etc window.
Sync source	SYNC SRCE on the ECG etc window.
Pacing spike detection on /off	PACING DETECT on the ECG etc window.
Pacing mark display on/off	PACING MARK on the SYSTEM SETUP screen. Refer to Section 3.
Filters on/off	DRIFT FREE FILTER, AC LINE NOISE FILTER and HIGH CUT FILTER on the SYSTEM SETUP screen. Refer to Section 3.

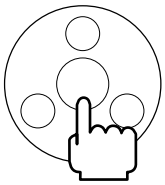
The settings on the SYSTEM SETUP screen must be changed before starting monitoring. To change settings on the SYSTEM SETUP screen, refer to Section 3.

Changing the Heart Rate or Pulse Rate Alarm Limits

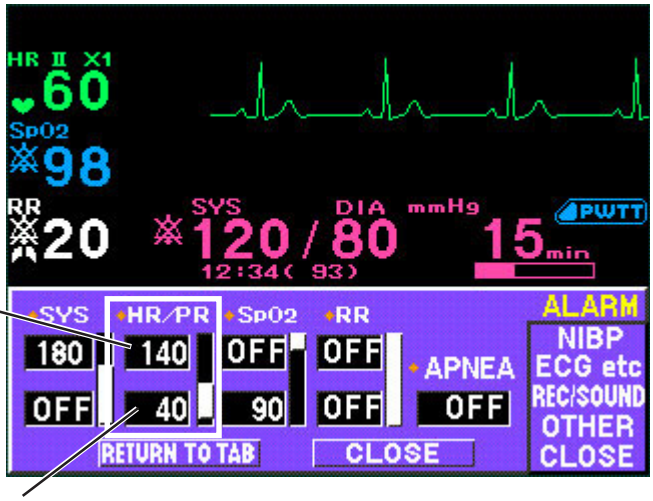
CAUTION

When the upper or lower alarm limit is turned off, there will be no heart rate upper or lower alarm for that limit.

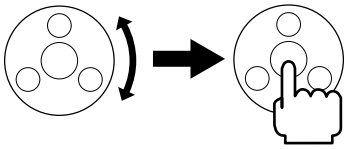
Set the upper and lower heart rate (pulse rate) alarm limits on the ALARM window.



1. From the monitoring screen, press the rotary dial center key on the front panel. The ALARM window opens.



2. Press the rotary dial center key to enter the ALARM window. The cursor moves to the “SYS” upper box.



3. Turn the rotary dial to move the cursor to the “HR/PR” upper box, press the rotary dial center key to change the cursor color to blue, turn the rotary dial to select the heart rate upper limit, and press the rotary dial center key to register the limit.

   Turn the rotary dial to move the cursor to the “HR/PR” lower box, press the rotary dial center key to change the cursor color to blue, turn the rotary dial to select the heart rate lower limit, and press the rotary dial center key to register the limit.

	Setting Range (beats/min)	Initial Setting
Upper Limit:	20 to 300, OFF (5/step)	140
Lower Limit:	OFF, 15 to 295 (5/step)	40

   If the upper limit is set to a value above the maximum or the lower limit is set to a value below the minimum, the alarm is set to OFF.

4. To return to the monitoring screen, select “CLOSE” on the ALARM window or press the HOME/REVIEW key on the front panel.

Changing the Monitoring Lead

Select the monitoring lead from I, II and III on the ECG etc window. The initial setting is II.

NOTE

Follow the physician’s instructions for lead position when available.

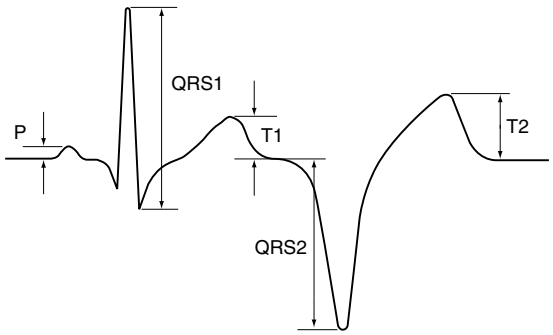
It is generally considered that Lead II and Lead V1 are suitable for ECG monitoring.

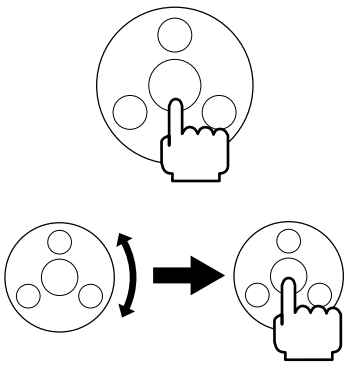
Some types of ECGs are difficult for heart rate counting and the heart rate counting may not be accurate for some patients. In these cases, use the following procedure to find the appropriate lead for heart rate counting.

1. Measure the patient’s ECG with the standard 12 ECG leads using an ECG instrument.

2. Select the optimum lead according to the following guidelines:
   1) Select the lead with the highest QRS wave amplitude and least difference in amplitude compared with a VPC or pacing pulse.
      $0.5 \leq QRS1/QRS2 \leq 2$
   2) Select the lead with less than 0.2 mV amplitude of the P-wave.
      $P \leq 0.2$ mV

3) Select the lead with a T-wave amplitude which is less than one-third of the QRS wave.
T1 ≤ 1/3QRS1, T2 ≤ 1/3QRS2





Procedure

1. From the monitoring screen, press the rotary dial center key on the front panel. The ALARM window opens.

2. Turn the rotary dial to select “ECG etc” and press the rotary dial center key to enter the ECG etc window. The cursor moves to the “ECG SENS” box.

3. Turn the rotary dial to move the cursor to “ECG LEAD”, press the rotary dial center key to change the cursor color to blue, turn the rotary dial to select the lead, and press the rotary dial center key to register the lead.

4. To return to the monitoring screen, select “CLOSE” on the ECG etc window or press the HOME/REVIEW key on the front panel.

Changing the ECG Sensitivity

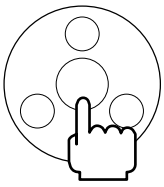
For stable QRS detection, select the sensitivity so that the amplitude of the QRS is larger than 1 cm on the monitoring screen.

The sensitivity can be set manually or automatically. When there is noise, AUTO sensitivity is not possible.

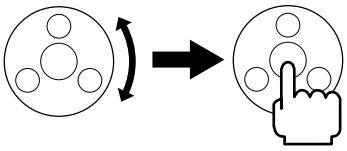
The sensitivity determines the size of the waveform on both the screen and recording paper.

When the sensitivity changes, the amplitude of the triangle wave that can be detected changes as shown below. The triangle wave width is 80 ms.

Sensitivity	Detectable Triangle Wave Amplitude
× 4	75 mV
× 2	150 mV
× 1	300 mV
× 1/2	600 mV
× 1/4	1200 mV



1. From the monitoring screen, press the rotary dial center key on the front panel. The ALARM window opens.



2. Turn the rotary dial to select “ECG etc” and press the rotary dial center key to enter the ECG etc window. The cursor moves to the “ECG SENS” box.

3. Press the rotary dial center key to change the cursor color to blue, turn the rotary dial to select the sensitivity, and press the rotary dial center key to register the sensitivity.

   Select the sensitivity from AUTO, ×1/4, ×1/2, ×1, ×2 and ×4.

4. To return to the monitoring screen, select “CLOSE” on the ECG etc window or press the HOME/REVIEW key on the front panel.

Turning Pacing Spike Detection On/Off

When the patient has an implanted cardiac pacemaker, set this to ON to detect pacemaker spike and remove the pacing pulse from the heart rate to allow correct heart rate counting.

When you monitor a premature baby or infant and the monitor miscounts the narrow width QRS, set this to OFF.

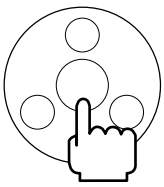
When the pacing spike detection is set to ON, the pacing mark can be displayed on the ECG. To display the pacing mark, set "PACING MARKER" to ON on the SYSTEM SETUP screen. Refer to Section 3.

WARNING

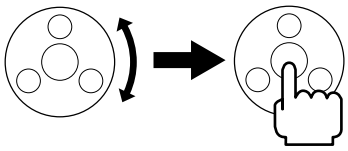
- **False low heart rate indicators or false asystole calls may occur with certain pacemakers because of electrical overshoots.**
- **Pacemaker patients can only be monitored when the pace program is active.**
- **Keep pacemaker patients under close observation. The pacemaker rate may be counted during cardiac arrest and certain arrhythmias. Do not rely only on the monitor.**

CAUTION

Turn the pacing spike detection to ON when monitoring a pacemaker patient. Otherwise QRS and pacemaker spike may not be distinguished and pacemaker failure may not be recognized.



1. From the monitoring screen, press the rotary dial center key on the front panel. The ALARM window opens.



2. Turn the rotary dial to select "ECG etc" and press the rotary dial center key to enter the ECG etc window. The cursor moves to the "ECG SENS" box.

3. Turn the rotary dial to move the cursor to “PACING DETECT” and press the rotary dial center key to select ON or OFF.

4. To return to the monitoring screen, select “CLOSE” on the ECG etc window or press the HOME/REVIEW key on the front panel.

Changing the Sync Source

Usually, the sync source is ECG (heart rate). You can change the sync source to SpO_2 (SpO_2 pulse) or AUTO. When the sync source is SpO_2, the heart rate on the monitoring screen changes to SpO_2 pulse rate.

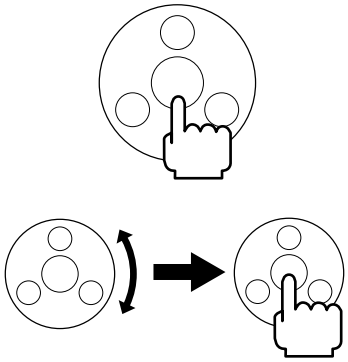
When AUTO is set, the sync source changes in the following priority.

ECG > SpO_2 > NIBP

When heart rate is unstable because of an electrosurgical unit, select SpO_2.

When the sync source is set to ECG and ECG is not monitored, there is no sync sound.

When the sync source is NIBP, there is no sync sound. Only the pulse rate detected from the NIBP measurement is displayed.



1. From the monitoring screen, press the rotary dial center key on the front panel. The ALARM window opens.

2. Turn the rotary dial to select “ECG etc” and press the rotary dial center key to enter the ECG etc window. The cursor moves to the “ECG SENS” box.

3. Turn the rotary dial to move the cursor to “SYNC SRCE”, press the rotary dial center key to change the cursor color to blue, turn the rotary dial to select ECG, SpO_2 or AUTO, and press the rotary dial center key to register the setting.

4. To return to the monitoring screen, select “CLOSE” on the ECG etc window or press the HOME/REVIEW key on the front panel.

Use with an Electrosurgical Unit

For use with an electrosurgical unit (ESU), this monitor has a circuit to protect the patient from skin burn. However, the effectiveness of this circuit depends on electrode position and monitor setup. With an ESU, pay attention to the following points.

WARNING

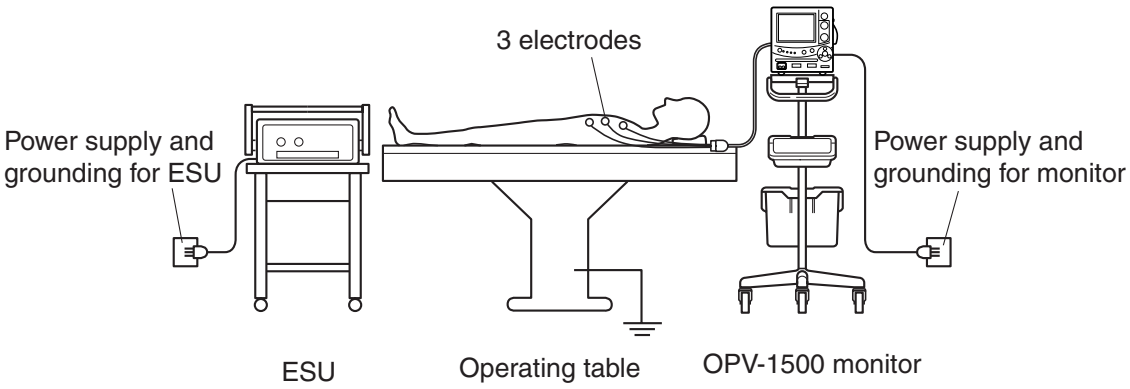
When using this monitor with an ESU, the ESU return plate and the electrodes for monitoring must be firmly attached to the patient. If the return plate is not attached correctly, it may burn the patient's skin where the electrodes are attached. Refer to the instruction manual for the ESU.

CAUTION

Install the monitor and ESU appropriately and perform equipotential grounding. Otherwise, noise from the ESU may interfere with the ECG and ECG monitoring may not be performed properly.

- Arrangement
  Install the monitor as far from the ESU as possible. If possible, locate them on opposite sides of the operating table.

- Power Supply
  Noise from the ESU may interfere with the ECG signal through the AC power line. Supply power to the monitor and ESU from different outlets located as far from each other as possible. Do the equipotential grounding properly.



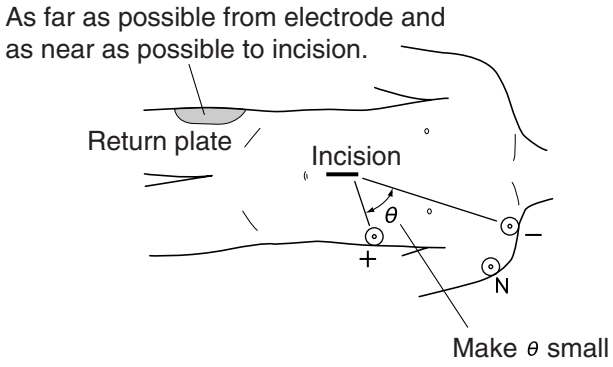
- Use new electrodes.

- Minimizing Noise
  1. Select an ECG lead where the active ECG electrodes are located as far from the incision as possible.

  2. Position the + and − electrodes as close as possible.

  3. Select the leads where the angle (θ) between the active electrodes and the incision is as small as possible.

  4. Set the electrosurgical return plate as close to the incision as possible.



- Set the following items.
  DRIFT FREE FILTER,
  AC LINE NOISE FILTER and
  HIGH CUT FILTER on the SYSTEM SETUP screen: ON
  SYNC SRCE on the ECG etc window: SpO_2
  (When the heart rate is unstable because of an ESU, select SpO_2.)

- Stop respiration monitoring
  Noise is superimposed on the waveform and the respiration rate cannot be monitored accurately in the impedance method. When monitoring respiration, turn respiration monitoring off.

Section 8 Respiration Monitoring

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- Preparation Flowchart 8.2
- Electrode Position and Waveform Examples 8.2
- Connecting Cables and Attaching Disposable Electrodes 8.4

Monitoring Respiration 8.5
- Respiration Information on the Monitoring Screen 8.5

Changing Respiration Settings 8.6
- Changing the Respiration Rate Alarm Limits 8.6
- Changing the Apnea Alarm Limit 8.7
- Changing the Respiration Sensitivity 8.8
- Turning Respiration Monitoring Off 8.9

General

On this monitor, respiration can be measured by impedance method. In the impedance method, respiration is measured and monitored by attaching the ECG electrodes to the patient and connecting them to the ECG/RESP socket on the monitor. This method measures changes in impedance between the R and F (RA and LL) ECG electrodes.

When the ESU is used in impedance method, noise is superimposed on the waveform and respiration rate cannot be monitored accurately. In such a case, turn the respiration monitoring off.

WARNING

Interaction Between Minute Ventilation Rate-Adaptive Pacemakers and Cardiac Monitoring and Diagnostic Equipment*

The bioelectric impedance measurement sensor of a minute ventilation rate-adaptive implantable pacemaker may be affected by cardiac monitoring and diagnostic equipment which is connected to the same patient. If this occurs, the pacemaker may pace at its maximum rate and give incorrect data to the monitor or diagnostic equipment. If this occurs, disconnect the monitor or diagnostic equipment from the patient or change the setting on the pacemaker by referring to the pacemaker's manual. For more details, contact your pacemaker distributor or Nihon Kohden distributor.

* Minute ventilation is sensed in rate-adaptive pacemakers by a technology known as bioelectric impedance measurement (BIM). Many medical devices in addition to pacemakers use this technology. When one of these devices is used on a patient with an active, minute ventilation rate-adaptive pacemaker, the pacemaker may erroneously interpret the mixture of BIM signals created in the patient, resulting in an elevated pacing rate.

  For more information, see the FDA web site.
  http://www.fda.gov/cdrh/safety.html

Preparing for Respiration Monitoring

Preparation Flowchart

The procedure is the same as for monitoring ECG.

1. Select the appropriate electrodes for the patient.
2. Connect the electrode lead to the ECG connection cord and ECG connection cord to the ECG/RESP socket on the monitor.
3. Attach the disposable electrodes to the patient and attach the electrode lead to the electrodes. Attach R and F (RA and LL) with the lungs between the electrodes.
4. Monitoring starts. Set necessary settings.

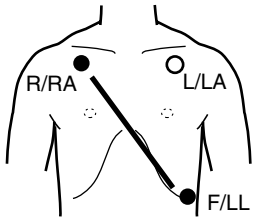
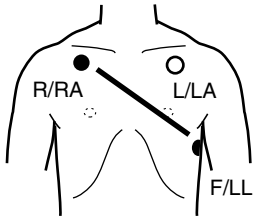
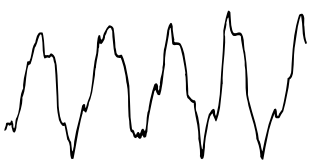
   For handling accessories after use, refer to Section 12.

Electrode Position and Waveform Examples

Respiration can be measured by the impedance method when the R (RA) and F (LL) electrodes are placed so that the lungs are between the electrodes.

The optimum electrode positions for ECG monitoring of a patient are not always optimum for respiration monitoring of the patient. Select the optimum positions for both ECG and respiration measurements.

The amplitude of the respiration waveform differs according to the electrode positions. The following shows different examples of respiration waveforms according to the electrode position when monitoring with the impedance method.

Electrode lead and position	162 cm 47 kg female	153 cm 45 kg female
①  Standard R-F/RA-LL		
②  R-F/RA-LL with higher F/LL position		

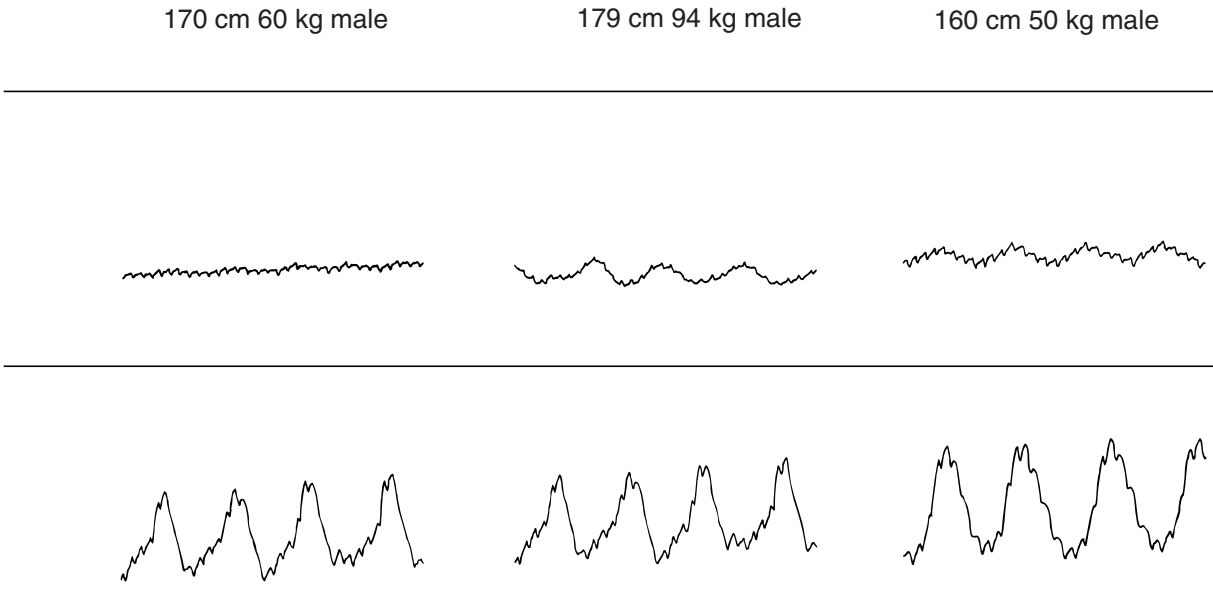
Electrode Position

	R or RA	F or LL
①	Right infraclavicular fossa	Lowest rib on the left anterior axillary line
②	Right infraclavicular fossa	Fifth intercostal space on the left midaxillary line

Explanation

① Respiration measurement is influenced by movement of the chest and abdomen. The amplitude of the waveform changes greatly according to slight change of the F (LL) electrode position. It also differs considerably between different patients.

② Respiration amplitude is large, and therefore, detection rate is good. The electrode position is similar to lead II of the ECG. This position is highly recommended.



Connecting Cables and Attaching Disposable Electrodes

Connecting cables and attaching disposable electrodes are the same as for the ECG monitoring. Refer to “Preparing for ECG Monitoring” in Section 7.

Monitoring Respiration

When preparation is done properly, the respiration waveform appears on the screen.

The respiration data do not appear on the screen when RESP SENS on the ECG etc window is set to OFF.

WARNING

When using an ESU, set RESP SENS to OFF. The noise from ESU is superimposed on the waveform and the respiration measurement cannot be monitored accurately.

For error messages and monitoring problems, refer to Section 11.

Respiration Information on the Monitoring Screen

Changing Respiration Settings

The following settings can be changed for respiration monitoring.

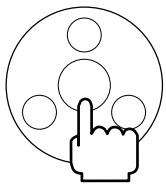
Setting Item	Setting Screen
Respiration rate alarm limits	RR on the ALARM window.
Apnea alarm limit	APNEA on the ALARM window.
Respiration sensitivity	RESP SENS on the ECG etc window.
Respiration monitoring off	RESP SENS on the ECG etc window.
APNEA alarm level	ALARM LEVEL OF APNEA on the SYSTEM SETUP screen. Refer to Section 3.
Reduce heart beat noise on the respiration waveform	NOISE REDUCTION ON RESP on the SYSTEM SETUP screen. Refer to Section 3.

The settings on the SYSTEM SETUP screen must be changed before starting monitoring. To change settings on the SYSTEM SETUP screen, refer to Section 3.

Changing the Respiration Rate Alarm Limits

CAUTION

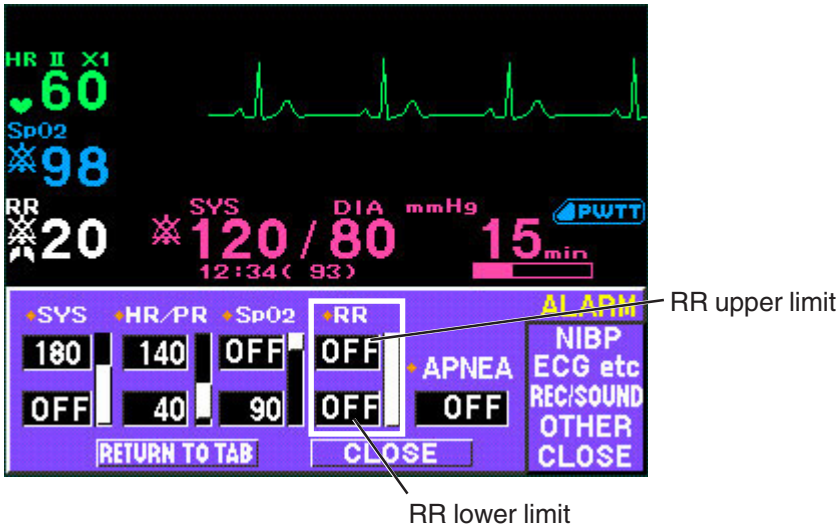
When the upper or lower alarm limit is turned off, there will be no respiration rate upper or lower alarm for that limit.

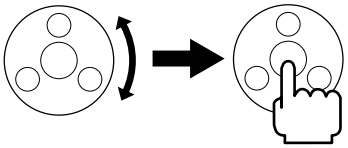


Set the upper and lower respiration rate alarm limits on the ALARM window.

1. From the monitoring screen, press the rotary dial center key on the front panel. The ALARM window opens.

2. Press the rotary dial center key to enter the ALARM window. The cursor moves to the “SYS” upper box.





3. Turn the rotary dial to move the cursor to the “RR” upper box, press the rotary dial center key to change the cursor color to blue, turn the rotary dial to select the respiration rate upper limit, and press the rotary dial center key to register the limit.

   Turn the rotary dial to move the cursor to the “RR” lower box, press the rotary dial center key to change the cursor color to blue, turn the rotary dial to select the respiration rate lower limit, and press the rotary dial center key to register the limit.

	Setting Range (counts/min)	Initial Setting
Upper Limit:	2 to 150, OFF (2/step)	OFF
Lower Limit:	OFF, 0 to 148 (2/step)	OFF

   If the upper limit is set to a value above the maximum or the lower limit is set to a value below the minimum, the alarm is set to OFF.

4. To return to the monitoring screen, select “CLOSE” on the ALARM window or press the HOME/REVIEW key on the front panel.

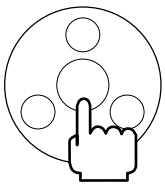
Changing the Apnea Alarm Limit

CAUTION

When the alarm limit is turned off, there will be no apnea alarm.

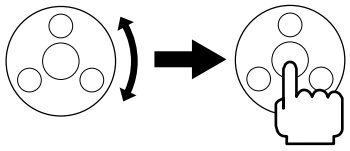
Set the apnea alarm limit on the ALARM window.

The alarm level for the APNEA alarm can be set to either crisis or warning at ALARM LEVEL OF APNEA on the SYSTEM SETUP screen. Refer to Section 3.



1. From the monitoring screen, press the rotary dial center key on the front panel. The ALARM window opens.

2. Press the rotary dial center key to enter the ALARM window. The cursor moves to the “SYS” upper box.



3. Turn the rotary dial to move the cursor to the “APNEA” box, press the rotary dial center key to change the cursor color to blue, turn the rotary dial to select the apnea limit, and press the rotary dial center key to register the limit.

Setting Range (s)	Initial Setting
5 to 40, OFF (5/step)	OFF

If the limit is set to a value above the maximum, the alarm is set to OFF.

4. To return to the monitoring screen, select “CLOSE” on the ALARM window or press the HOME/REVIEW key on the front panel.

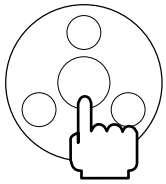
Changing the Respiration Sensitivity

The respiration waveform amplitudes larger than 1 cm are counted for the respiration rate. When the sensitivity is too low, respiration waveform cannot be detected and the respiration rate cannot be counted. Select the sensitivity so that the amplitude of the respiration waveform is larger than 1 cm.

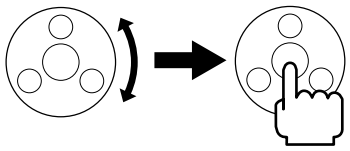
The sensitivity determines the size of the waveform on both the screen and recording paper.

NOTE

When the respiration sensitivity is set to OFF, the respiration monitoring is turned off.



1. From the monitoring screen, press the rotary dial center key on the front panel. The ALARM window opens.



2. Turn the rotary dial to select “ECG etc” and press the rotary dial center key to enter the ECG etc window. The cursor moves to the “ECG SENS” box.

3. Turn the rotary dial to move the cursor to “RESP SENS”, press the rotary dial center key to change the cursor color to blue, turn the rotary dial to select the sensitivity, and press the rotary dial center key to register the sensitivity.

   Select the sensitivity from OFF, ×1/4, ×1/2, ×1, ×2 and ×4.

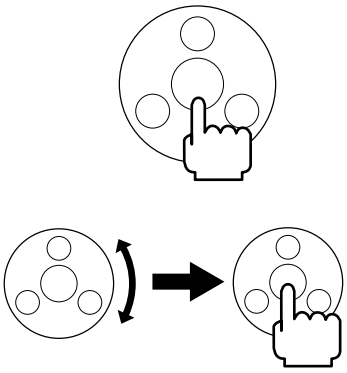
4. To return to the monitoring screen, select “CLOSE” on the ECG etc window or press the HOME/REVIEW key on the front panel.

Turning Respiration Monitoring Off

You can turn respiration monitoring off if you do not need it. When respiration is turned off, the respiration waveform and respiration rate do not appear and the “RESP OFF” message appears on the monitoring screen. The respiration monitoring can be turned off by selecting “OFF” for RESP SENS on the ECG etc window.

WARNING

When using an ESU, set RESP SENS to OFF. The noise from ESU is superimposed on the waveform and the respiration measurement cannot be monitored accurately.



1. From the monitoring screen, press the rotary dial center key on the front panel. The ALARM window opens.

2. Turn the rotary dial to select “ECG etc” and press the rotary dial center key to enter the ECG etc window. The cursor moves to the “ECG SENS” box.

3. Turn the rotary dial to move the cursor to “RESP SENS”, press the rotary dial center key to change the cursor color to blue, turn the rotary dial to select “OFF”, and press the rotary dial center key to register the setting.

4. To return to the monitoring screen, select “CLOSE” on the ECG etc window or press the HOME/REVIEW key on the front panel.

Section 9 SpO_2 Monitoring

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Preparing for SpO_2 Monitoring 9.2
Preparation Flowchart 9.2
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Nihon Kohden Reusable Probes 9.3
Nihon Kohden Disposable Probes 9.4
Connecting Cables 9.5
Connecting Cable to the Monitor 9.5
Attaching the Probe to the Patient 9.6
Attaching the TL-201T Finger Probe 9.7
Attaching the TL-251T/252T/253T Disposable Probes 9.7
Monitoring SpO_2 ..... 9.10
SpO_2 Information on the Monitoring Screen 9.11
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M Message 9.12
Changing SpO_2 Settings 9.13
Changing the SpO_2 Alarm Limits 9.13
Changing the Pulse Waveform Sensitivity 9.14
Changing the Sync Source 9.15
Selecting Sync Sound Pitch 9.16

General

SpO_2 is monitored by attaching a probe to the patient and using the SpO_2 socket on the monitor.

WARNING

- **Measurement may be incorrect in the following cases.**
  - **When the oxyhemoglobin or methemoglobin (HbCO, Met Hb) increases abnormally.**
  - **When dye is injected in the blood.**
  - **When using an electrosurgical unit.**
  - **During CPR.**
  - **When measuring at a site where there are venous pulses.**
  - **When there is body movement.**
  - **When the pulse wave is small.**
- **Check the circulation condition by observing the skin color of the measuring site and pulse waveform. Change the measuring site every 8 hours for disposable probes and every 4 hours for reusable probes. The skin temperature may increase at the attached site by 2 or 3°C (4 or 5°F) and cause a burn or pressure necrosis. When using the probe on the following patients, take extreme care and change the measurement site more frequently according to symptoms and degree.**
  - **A patient with a fever**
  - **A patient with peripheral circulation insufficiency**
  - **Neonate or low birth weight infant with delicate skin**
- **To avoid poor circulation, do not wrap the tape too tight. Check the blood circulation condition by observing the skin color and congestion at the skin peripheral to the probe attachment site. Even for short-term monitoring, there may be burn or pressure necrosis from poor blood circulation, especially on neonates or low birth weight infants whose skin is delicate. Accurate measurement cannot be performed on a site with poor peripheral circulation.**
- **When not monitoring SpO_2, disconnect the SpO_2 connection cord from the monitor. Otherwise, noise may interfere from the probe sensor and incorrect data is displayed on the screen.**

CAUTION

- **Turn off the power of cell telephones, small wireless devices and other devices which produce strong electromagnetic interference. Otherwise, the waveforms and measurements are affected by such interference and the displayed data may be incorrect.**
- **Normally external light does not affect monitoring, however, strong light such as an operating lamp or sunlight may affect monitoring. If affected, cover the measuring site with a blanket.**

- **Do not pull or bend the probe cable, and do not put caster feet on the probe cable. Do not immerse the probe cable in detergents or water. Failure to follow these cautions may cause cable discontinuity, short circuit, skin burn on the patient and incorrect measurement data. Replace any broken probe with a new one.**

Preparing for SpO_2 Monitoring

Preparation Flowchart

1. Select the probe.
2. Connect the probe to the SpO_2 connection cord and SpO_2 connection cord to the SpO_2 socket on the monitor.
3. Attach the probe to the patient.
4. Monitoring starts. Set necessary settings.
   For handling accessories after use, refer to Section 12.

Selecting a Probe

Select the appropriate probe according to the purpose.

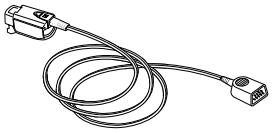
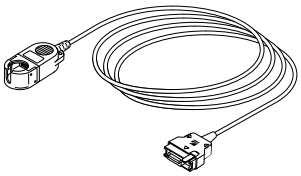
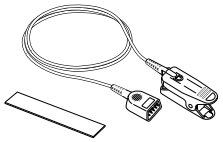
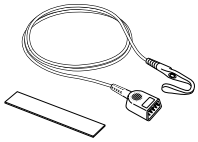
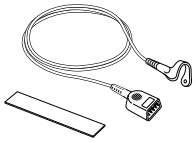
WARNING

Do not use the probe during MRI examination because it may cause skin burn on the probe attachment area. For details, follow the MRI operator's manual.

CAUTION

- **Only use the specified probe. Otherwise measured data may be incorrect.**
- **Do not use a disassembled or damaged probe because measured data may be incorrect.**
- **Do not use the probe over its stated lifetime. Otherwise the SpO_2 measurement accuracy cannot be guaranteed.**

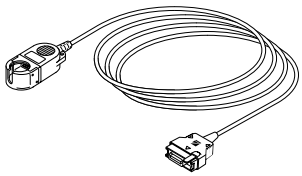
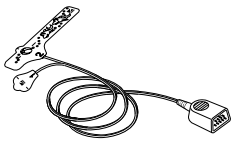
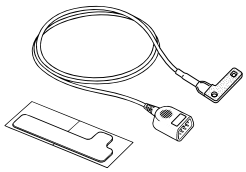
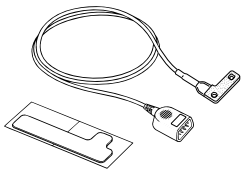
Nihon Kohden Reusable Probes

Model	Subject (Weight)	Attachment Site	SpO2 Connection Cord
Finger Probe TL-201T 	Adults, children (Weight more than 20 kg)	Finger	JL-302T 
Finger Probe TL-101T 	Adults, children (Weight more than 20 kg)	Finger or toe	
Multi-site Probe TL-120T 	Adults, children, infants (Weight more than 3 kg)	Finger or toe	
Foot Probe TL-121T 	Infants, neonates (Weight less than 3 kg)	Instep and sole	

Nihon Kohden Disposable Probes

CAUTION

- **Do not reuse disposable probes for another patient.**
- **Disposable probes are not sterilized. To sterilize the probe, refer to "Sterilizing the Disposable Probe" in Section 12.**

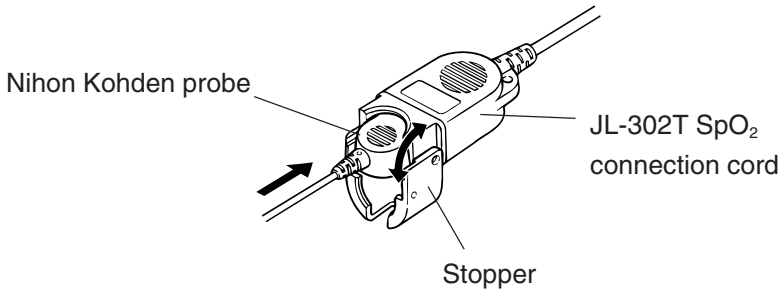
Model	Subject (Weight)	Attachment Site	SpO2 Connection Cord
TL-251T	Adults (Weight more than 30 kg)	Finger or toe	JL-302T 
TL-252T	Children (Weight from 3 to 40 kg)	Finger or toe	
TL-253T 	Neonates (Weight less than 3 kg)	Instep and sole	
TL-051S/052S  Cable length TL-051S: 80 cm TL-052S: 160 cm	Adults (Weight more than 50 kg)	Finger	
	Neonates (Weight less than 3 kg)	Instep and sole	
TL-061S/062S  Cable length TL-061S: 80 cm TL-062S: 160 cm	Adults, children (Weight from 15 to 50 kg)	Finger	
	Children, infants (Weight from 3 to 15 kg)	Toe	

Connecting Cables

Connecting Cable to the Monitor

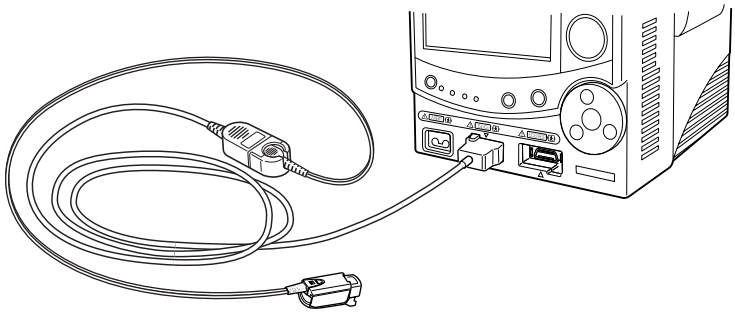
1. Open the stopper of the SpO_2 connection cord and connect the probe firmly.

2. Close the stopper.

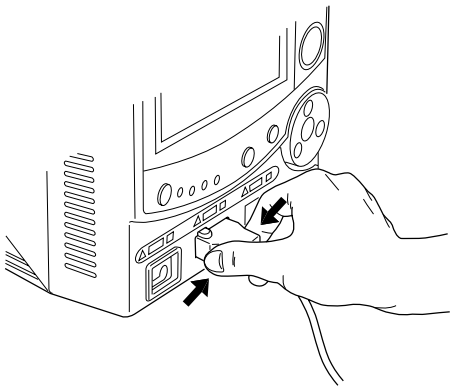


3. Connect the SpO_2 connection cord to the SpO_2 socket on the monitor.

When using TL-201T Finger Probe



To disconnect the SpO_2 connection cord from the monitor, press the buttons on both sides of the SpO_2 connection cord connector and pull it out.



Attaching the Probe to the Patient

WARNING

- **Check the circulation condition by observing the skin color of the measuring site and pulse waveform. Change the measuring site every 8 hours for disposable probes and every 4 hours for reusable probes. The skin temperature may increase at the attached site by 2 or 3°C (4 or 5°F) and cause a burn or pressure necrosis. When using the probe on the following patients, take extreme care and change the measurement site more frequently according to symptoms and degree.**
  - **A patient with a fever**
  - **A patient with peripheral circulation insufficiency**
  - **Neonate or low birth weight infant with delicate skin**
- **To avoid poor circulation, do not wrap the tape too tight. Check the blood circulation condition by observing the skin color and congestion at the skin peripheral to the probe attachment site. Even for short-term monitoring, there may be burn or pressure necrosis from poor blood circulation, especially on neonates or low birth weight infants whose skin is delicate. Accurate measurement cannot be performed on a site with poor peripheral circulation.**

CAUTION

- **When the attachment site is wet with blood or when the patient has nail polish on, remove dirt and nail polish before attaching the probe. The transmitted light may decrease due to blood or nail polish and the measurement data may be incorrect.**
- **When the probe is attached on an appropriate site with sufficient circulation and the error message confirming the probe attachment repeatedly appears, the probe may be deteriorated. Replace it with a new one.**
- **If the skin gets irritated by the tape, change the attachment site.**
- **Do not attach the probe to the same limb that is used for NIBP measurement or an IBP catheter.**
- **When attached, make sure that the photo emitter and the detector of the probe face each other. Otherwise, SpO_2 cannot be measured properly.**
- **Do not reuse the disposable probe for another patient.**
- **Do not use the probe over its stated lifetime. Otherwise the SpO_2 measurement accuracy cannot be guaranteed.**
- **Do not pull or bend the probe cable, and do not put caster feet on the probe cable. Do not immerse the probe cable in detergents or water. Failure to follow these cautions may cause cable discontinuity, short circuit, skin burn on the patient and incorrect measurement data. Replace any broken probe with a new one.**
- **Refer to the probe instruction manual for details.**

NOTE

If the patient has long fingernails, cut the nail. The probe cannot be attached properly if the nail is long.

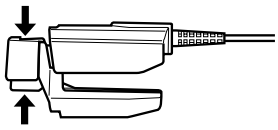
The light-transmission type probe requires the light to penetrate tissue of 6 to 14 mm thick (e.g. finger or toe). The best monitoring condition is tissue approximately 10 mm thick.

In this manual, attaching the TL-201T finger probe and TL-251T/252T/253T disposable probes is described. For attaching other probes, refer to the probe manual.

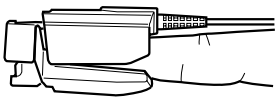
Attaching the TL-201T Finger Probe

To know the degree of probe deterioration, check the signal level of the new TL-201T probe when you start to use it. Use the signal level sheet at the end of this manual. Replace the probe with a new one when the signal level becomes half of the level at the first use. For details on how to check the signal level, refer to the service manual.

1. Clean the attachment site with alcohol.



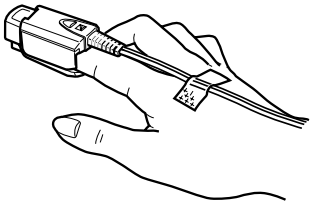
2. Press the button to open the probe.



3. Insert the finger into the probe. The ⍓ marked side must be on the nail side (the cable must be on the nail side) and there should be slight contact between the tip of the finger and the probe.

NOTE

Make sure that the cable is on the nail side. Otherwise measured data is not correct.

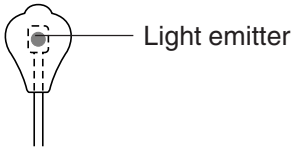


4. To minimize body movement and prevent extra force on the probe for stable SpO_2 monitoring, secure the cable to the back of the hand with surgical tape.

Attaching the TL-251T/252T/253T Disposable Probes

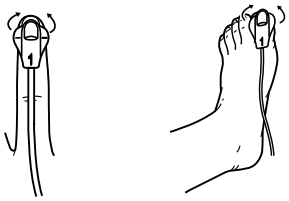
NOTE

- **When attached, make sure that the light emitter and the detector of the probe face each other. Otherwise, SpO_2 cannot be measured properly.**
- **Do not immerse the disposable probes in detergents or water. If the probe adhesive surface gets wet, adhesiveness becomes weak and the probe cannot be attached to the skin.**



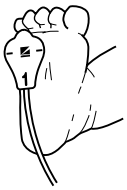
1. Wipe the attachment site with a cotton moistened with alcohol.

2. Remove the cover paper from the back of the probe piece 1 and attach the probe piece to the cleaned site.



TL-251T/252T

- When attaching TL-251T/252T
  Attach the entire probe piece to the finger or toe so that the center of the light emitter is on the base of the nail.

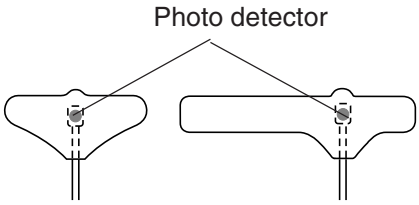


TL-253T

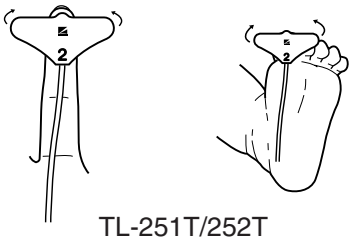
- When attaching TL-253T
  Attach the entire probe piece to the bottom of the foot so that the center of the light emitter aligns with the little toe and the edge of the light emitter is where the toe joins the foot.

NOTE

Do not attach the light emitter on a joint.

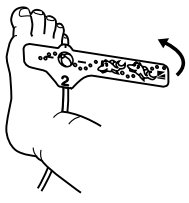


3. Remove the cover paper from the back of the probe piece 2 and attach the probe piece.



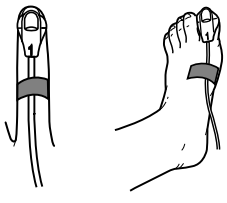
TL-251T/252T

- When attaching TL-251T/252T
  1) Attach the probe piece to the opposite side of the finger or toe from the nail, so that the center of the photo detector on the probe piece 2 exactly faces the light emitter on the probe piece 1.
  2) Wrap the left and right wing of the probe piece 2 one at a time around the finger or toe to attach the whole probe piece. Be careful not to wrinkle the wing.

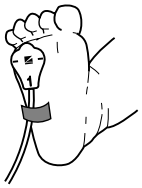


TL-253T

- When attaching TL-253T
  1) Attach the probe piece to the instep of the foot so that the center of the photo detector on the probe piece 2 exactly faces the light emitter on the probe piece 1.
  2) Wrap the probe piece around the foot to attach the whole probe piece.



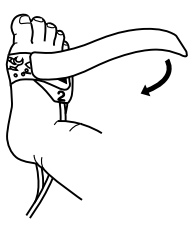
TL-251T/252T



TL-253T

4. For stable SpO_2 monitoring, secure the cable with surgical tape to minimize and prevent extra force on the probe.

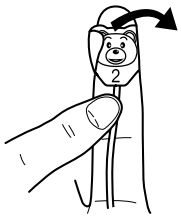
When the probe is repositioned and its adhesiveness becomes weak, use the provided tape to secure the probe.



Removing the TL-251T/252T/253T Disposable Probe from the Attachment Site

CAUTION

- **Be careful when removing the tape from neonatal skin.**
- **When removing a probe that is taped to the skin, do not pull the cable part of the probe because this can damage the probe's cable connection.**



Hold the cable where it joins the probe piece and remove the probe piece slowly from the edge of it.

Monitoring SpO_2

When the preparation is done properly, the SpO_2 value and pulse waveform appear on the screen.

WARNING

- **Measurement may be incorrect in the following cases.**
  - **When the oxyhemoglobin or methemoglobin (HbCO, Met Hb) increases abnormally.**
  - **When dye is injected in the blood.**
  - **When using an electrosurgical unit.**
  - **During CPR.**
  - **When measuring at a site where there are venous pulses.**
  - **When there is body movement.**
  - **When the pulse wave is small.**
- **Check the circulation condition by observing the skin color of the measuring site and pulse waveform. Change the measuring site every 8 hours for disposable probes and every 4 hours for reusable probes. The skin temperature may increase at the attached site by 2 or 3°C (4 or 5°F) and cause a burn or pressure necrosis. When using the probe on the following patients, take extreme care and change the measurement site more frequently according to symptoms and degree.**
  - **A patient with a fever**
  - **A patient with peripheral circulation insufficiency**
  - **Neonate or low birth weight infant with delicate skin**
- **To avoid poor circulation, do not wrap the tape too tight. Check the blood circulation condition by observing the skin color and congestion at the skin peripheral to the probe attachment site. Even for short-term monitoring, there may be burn or pressure necrosis from poor blood circulation, especially on neonates or low birth weight infants whose skin is delicate. Accurate measurement cannot be performed on a site with poor peripheral circulation.**
- **When not monitoring SpO_2, disconnect the SpO_2 connection cord from the monitor. Otherwise, noise from the probe sensor may interfere and incorrect data is displayed on the screen.**

CAUTION

- **When the probe is attached on an appropriate site with sufficient circulation and the error message confirming the probe attachment repeatedly appears, the probe may be deteriorated. Replace it with a new one.**
- **When the probe or SpO_2 connection cord failure message appears on the screen, replace it with a new one. Otherwise SpO_2 data may not**

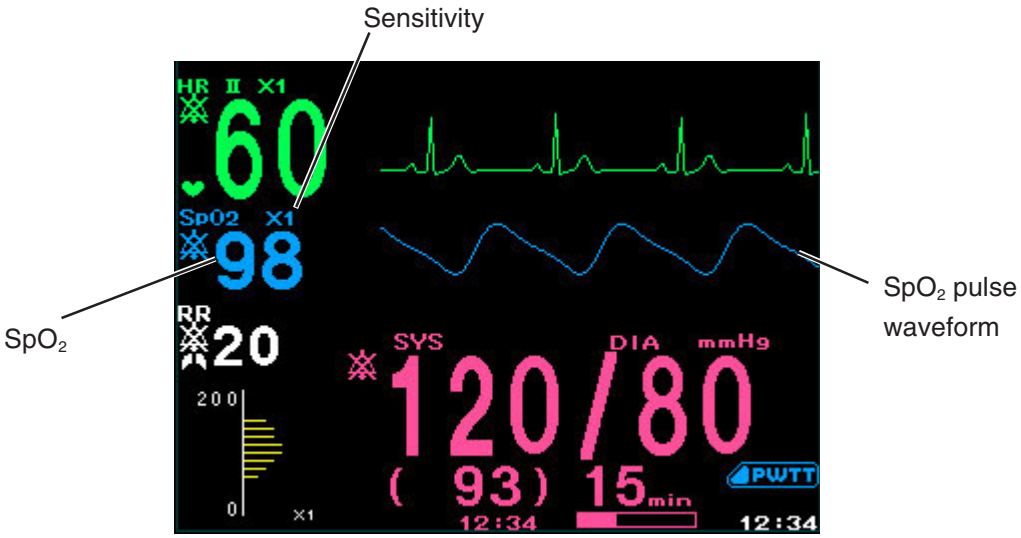
be accurate.

NOTE

In order to maintain sufficient blood circulation, keep the measurement site warm by covering with a blanket or something similar. Warming the site is effective, especially for a patient with a small pulse amplitude.

For error messages and monitoring problems, refer to Section 11.

SpO_2 Information on the Monitoring Screen



Detection and Display of Measurement Condition

NOTE

When the "SpO2 SEARCHING PULSE" message is displayed for a long time, it means that the detected pulse is too small to measure. Reposition the probe.

SpO2 CHECK PROBE Message (When the Finger Probe is Used)

Displayed when the SpO_2 connection cord is disconnected from the probe or SpO_2 socket on the monitor, the probe is not firmly attached to the patient, or the amount of transmitted light is too small for measurement.

Check the SpO_2 connection cord connection and firmly attach the probe to the patient or reposition the probe so that more light can pass through.

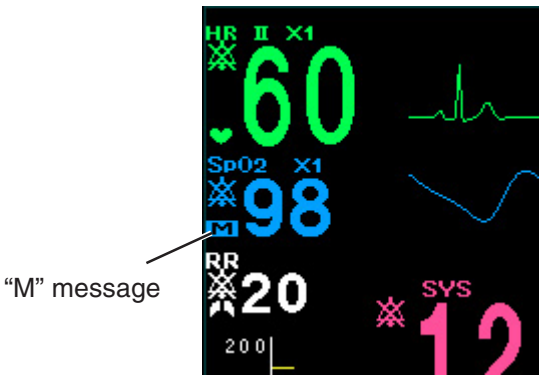
SpO2 SEARCHING PULSE Message

Displayed when the detected pulse waveform is too small.

After attaching the probe to the patient, it takes 10 to 20 seconds to automatically adjust the gain. When the pulse waveform is detected satisfactorily, the "SpO2 SEARCHING PULSE" message disappears and the SpO_2 value appears.

M Message

Displayed when there is considerable body movement or the probe attachment is unstable. When the message is displayed frequently, check the patient condition, and if necessary, change the probe attachment site.



Changing SpO_2 Settings

The following settings can be changed for SpO_2 monitoring.

Setting Item	Setting Screen
SpO2 alarm limits	SpO2 on the ALARM window.
SpO2 sensitivity	SpO2 SENS on the ECG etc window.
Sync source	SYNC SRCE on the ECG etc window.
Sync sound pitch	SpO2 PITCH on the ECG etc window.
SpO2 response mode	SpO2 RESPONSE on the SYSTEM SETUP screen. Refer to Section 3.
Probe off detection on or off	PROBE OFF DETECTION on the SYSTEM SETUP screen. Refer to Section 3.
Reducing AC interference from pulse waveform	LINE FREQUENCY on the SYSTEM SETUP screen. Refer to Section 3.

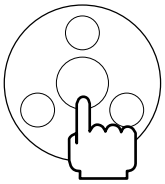
The settings on the SYSTEM SETUP screen must be changed before starting monitoring. To change settings on the SYSTEM SETUP screen, refer to Section 3.

Changing the SpO_2 Alarm Limits

CAUTION

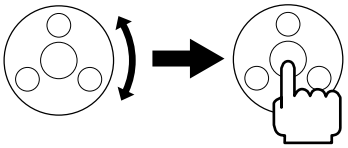
When the upper or lower alarm limit is turned off, there will be no SpO_2 upper or lower alarm for that limit.

Set the upper and lower SpO_2 alarm limits on the ALARM window.



1. From the monitoring screen, press the rotary dial center key on the front panel. The ALARM window opens.

2. Press the rotary dial center key to enter the ALARM window. The cursor moves to the “SYS” upper box.



3. Turn the rotary dial to move the cursor to the “SpO2” upper box, press the rotary dial center key to change the cursor color to blue, turn the rotary dial to select the SpO_2 upper limit, and press the rotary dial center key to register the limit.

   Turn the rotary dial to move the cursor to the “SpO2” lower box, press the rotary dial center key to change the cursor color to blue, turn the rotary dial to select the SpO_2 lower limit, and press the rotary dial center key to register the limit.

	Setting Range (%)	Initial Setting
Upper Limit:	51 to 100, OFF (1/step)	OFF
Lower Limit:	OFF, 50 to 99 (1/step)	90

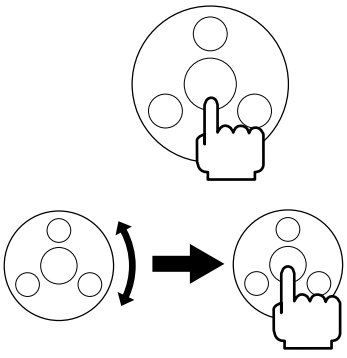
   If the upper limit is set to a value above the maximum or the lower limit is set to a value below the minimum, the alarm is set to OFF.

4. To return to the monitoring screen, select “CLOSE” on the ALARM window or press the HOME/REVIEW key on the front panel.

Changing the Pulse Waveform Sensitivity

The sensitivity determines the size of the waveform on both the screen and recording paper.

The sensitivity can be set manually or automatically. When you select AUTO sensitivity, the sensitivity is automatically determined.



1. From the monitoring screen, press the rotary dial center key on the front panel. The ALARM window opens.

2. Turn the rotary dial to select “ECG etc” and press the rotary dial center key to enter the ECG etc window. The cursor moves to the “ECG SENS” box.

3. Turn the rotary dial to select “SpO2 SENS” and press the rotary dial center key to change the cursor color to blue, turn the rotary dial to select the sensitivity, and press the rotary dial center key to register the sensitivity.

   Select the sensitivity from AUTO, ×1/8, ×1/4, ×1/2, ×1, ×2, ×4 and ×8.

4. To return to the monitoring screen, select “CLOSE” on the ECG etc window or press the HOME/REVIEW key on the front panel.

Changing the Sync Source

Usually, the sync source is ECG (heart rate). You can change the sync source to SpO_2 (SpO_2 pulse) or AUTO. When the sync source is SpO_2, the heart rate on the monitoring screen changes to SpO_2 pulse rate.

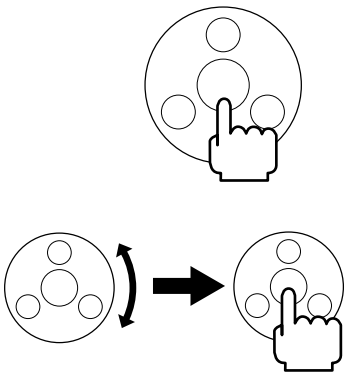
When AUTO is set, the sync source changes in the following priority.

ECG > SpO_2 > NIBP

When heart rate is unstable because of an electrosurgical unit, select SpO_2.

When the sync source is set to ECG and ECG is not monitored, there is no sync sound.

When the sync source is NIBP, there is no sync sound. Only the pulse rate detected from the NIBP measurement is displayed.



1. From the monitoring screen, press the rotary dial center key on the front panel. The ALARM window opens.

2. Turn the rotary dial to select “ECG etc” and press the rotary dial center key to enter the ECG etc window. The cursor moves to the “ECG SENS” box.

3. Turn the rotary dial to move the cursor to “SYNC SRCE”, press the rotary dial center key to change the cursor color to blue, turn the rotary dial to select ECG, SpO_2 or AUTO, and press the rotary dial center key to register the setting.

4. To return to the monitoring screen, select “CLOSE” on the ECG etc window or press the HOME/REVIEW key on the front panel.

Selecting Sync Sound Pitch

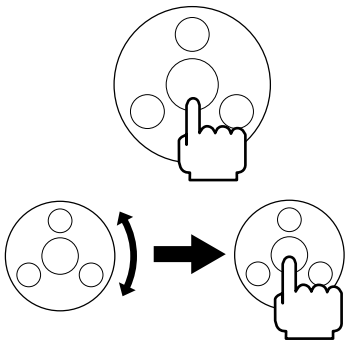
The sync sound can be variable pitch or fixed pitch pips. The fixed pitch is high pitch as the default, but medium or low pitch can also be set on the SYSTEM SETUP screen. See Section 3.

When SpO_2 is the sync source, you can set the sync sound pitch to vary according to SpO_2 value.

When the variable pitch with SpO_2 value is selected, the pitch of the sync sound changes as follows.

SpO2 Value	Pitch of Sync Sound
100 to 81%	High to low pitch, in 1% steps
Less than 81%	Low pitch

When the sync source is set to SpO_2 and the “SpO2 CHECK PROBE” or “SpO2 SEARCHING PULSE” message appears on the screen, the sync pitch is fixed low pitch.



1. From the monitoring screen, press the rotary dial center key on the front panel. The ALARM window opens.

2. Turn the rotary dial to select “ECG etc” and press the rotary dial center key to enter the ECG etc window. The cursor moves to the “ECG SENS” box.

3. Turn the rotary dial to move the cursor to “SpO2 PITCH” and press the rotary dial center key to select ON or OFF.

   When OFF is set, the sync pitch is fixed at the selected pitch on the SYSTEM SETUP screen.

4. To return to the monitoring screen, select “CLOSE” on the ECG etc window or press the HOME/REVIEW key on the front panel.

Section 10 NIBP Monitoring

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The NIBP measuring method in this monitor is licensed from Critikon Inc., U.S.A.

General

Non-invasive blood pressure is measured by wrapping the cuff on the patient and connecting the cuff to the NIBP socket on the monitor. On this monitor, noninvasive blood pressure is measured by the oscillometric method.

Oscillometric Method

The NIBP is measured from the change in amplitude pattern of pulsatile oscillation in cuff pressure as the cuff pressure is reduced from above systolic to below diastolic pressure. The occlusive-oscillometry method uses this to determine the systolic, diastolic, and mean arterial pressure.

Measurement Modes

There are three modes for NIBP measurement on this monitor. Refer to the "Selecting the Measurement Mode" section.

- Manual (single) measurement — Measurement is performed once.
- STAT (continuous) measurement — Measurement is performed for 15 minutes continuously.
- Automatic measurement — Measurement is performed automatically at preset time intervals. The time interval can be selected.
  Automatic measurement can also be performed with PWTT.

WARNING

- **NIBP measurement on a sickle cell anemia patient may cause a thrombus.**
- **When attaching the cuff to a premature infant at an early stage after birth, periodically change the cuff position to avoid possible skin erosion and fissure.**

CAUTION

Do not wrap the cuff on the arm or thigh which is used for injection. NIBP measurement on an arm or thigh which is used for injection may cause a reflux of blood and stop injection.

Preparing for NIBP Measurement

Preparation Flowchart

1. Select the cuff.
2. Connect the cuff to the air hose and the air hose to the NIBP socket on the monitor.
3. Attach the cuff to the patient.
4. Set necessary settings.
5. Start measurements.
   For handling accessories after use, refer to Section 12.

Selecting the Cuff

CAUTION

- **Only use the specified cuff. Otherwise NIBP monitoring cannot be performed properly or the monitor may be damaged.**
- **Select the cuff which fits each patient. If the cuff size is not correct, measurement may not be completed or the result may be incorrect.**

Select the appropriate cuff according to the purpose.

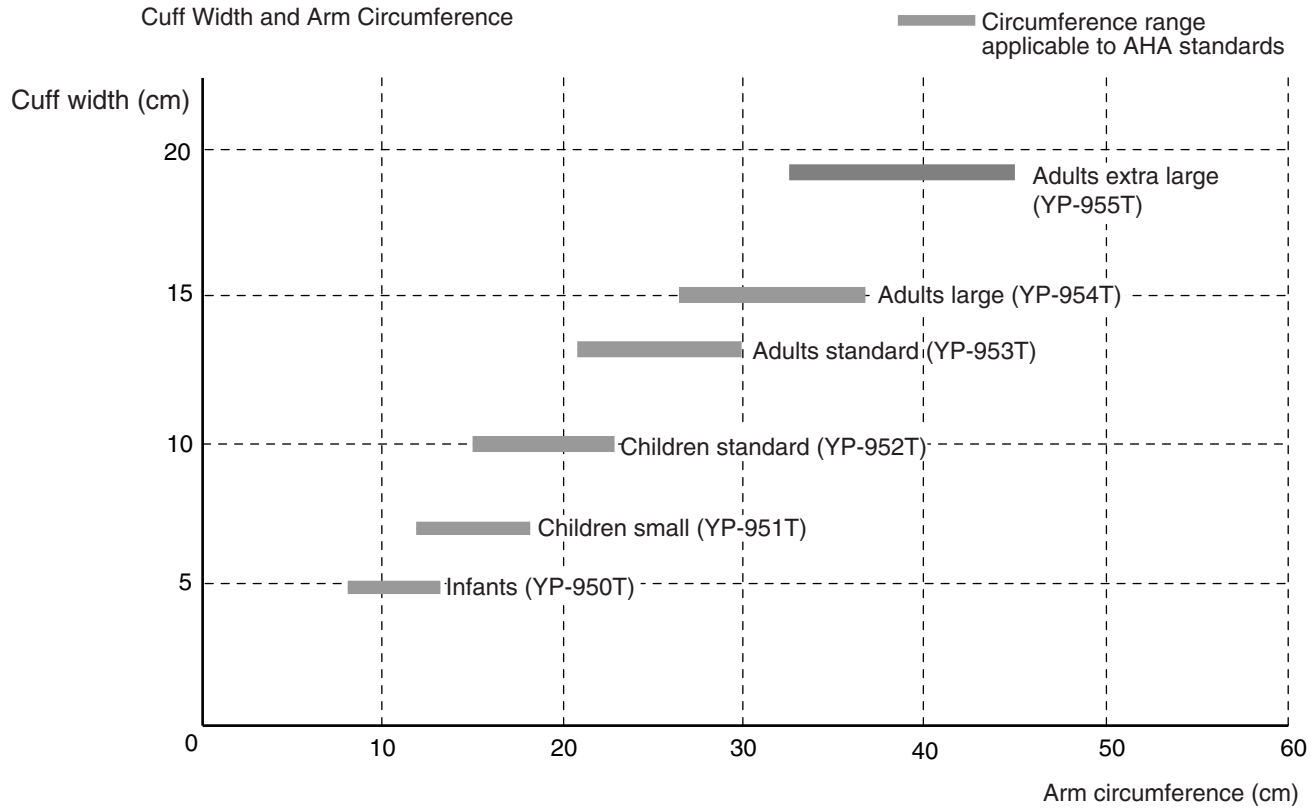
The AHA (American Heart Association) recommends that the cuff width be 40% of the circumference of the upper arm. Refer to the following graph and select the cuff which suits the patient's arm.

NOTE

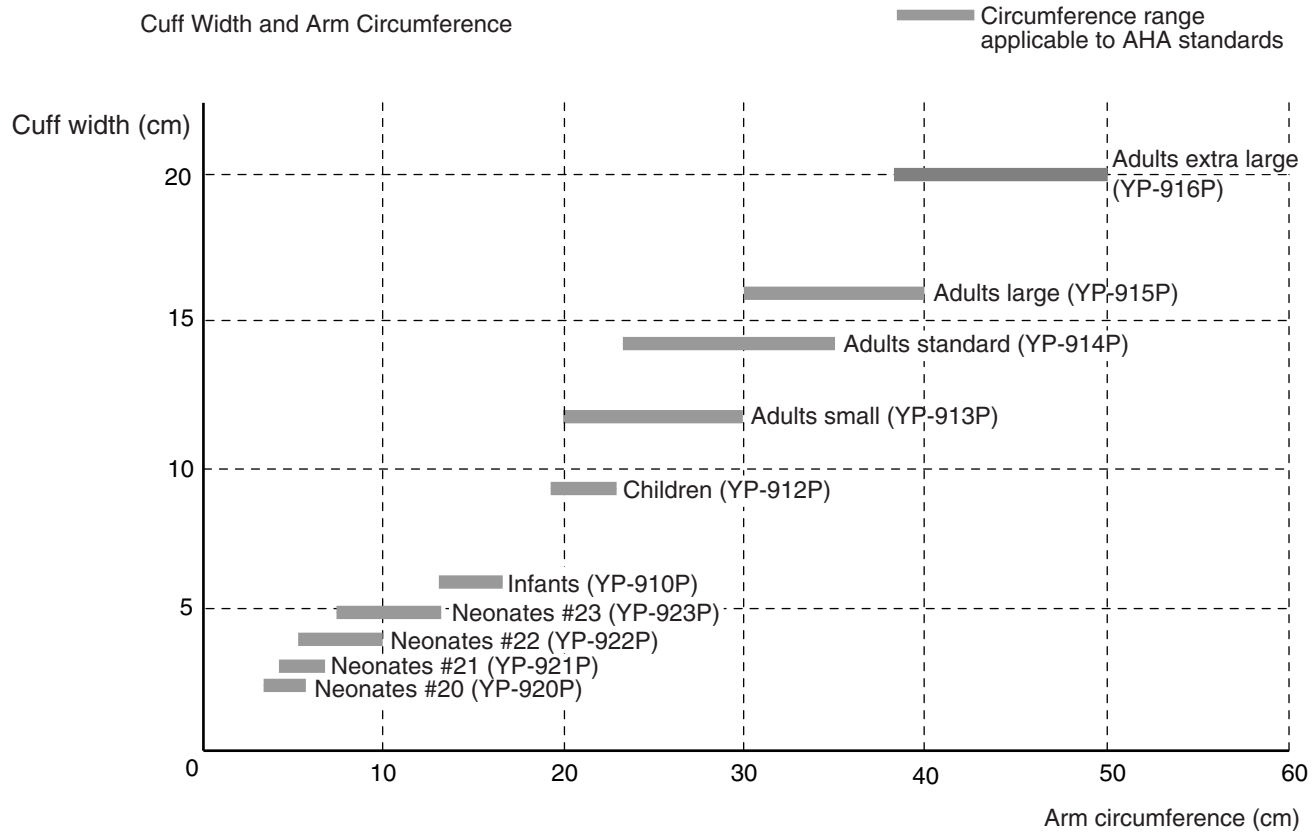
- **If the range of arm circumference appropriate for the cuff is prescribed, use within that range.**
- **To obtain accurate measured values, select a wide cuff which can be attached to the upper arm or the thigh (calf in the case of neonates). Measuring with a very narrow cuff may result in measured values higher than the actual values.**

Cuff Width and Arm Circumference

YP-950T/951T/952T/953T/954T/955T cuffs



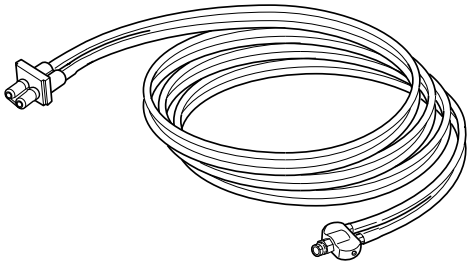
YP-910P/912P/913P/914P/915P/916P/920P/921P/922P/923P cuffs



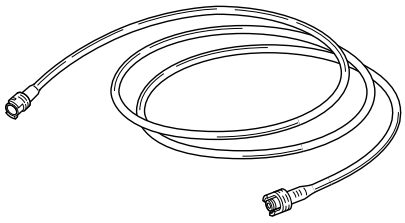
Types of Cuffs

Reusable Cuffs

When using the following reusable cuffs, a YN-100T (1.5 m) or YN-101T (3.5 m) air hose is required. A YN-990P (1.5 m) extension hose is also available.

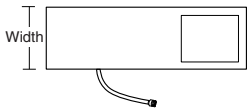
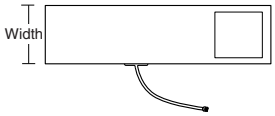


YN-101T Air hose



YN-990P Extension hose

For the YP-950T/951T/952T/953T/954T/955T reusable cuffs, the cloth cover can be separated from the rubber hose so that the cloth cover can be washed. The rubber hose contains natural rubber latex.

Cuff			Width (cm)	Applicable circumference (cm)	Shape
For infants		YP-950T*	5	8 to 13	
For children	Small	YP-951T*	7	12 to 18	
	Standard	YP-952T*	10	15 to 23	
For adults	Standard	YP-953T*	13	21 to 30	
	Large	YP-954T*	15	26 to 36	
For thigh		YP-955T*	19	33 to 45	

CAUTION

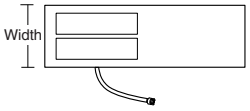
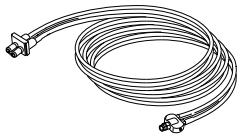
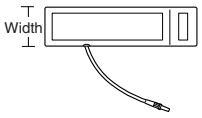
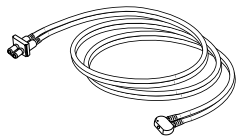
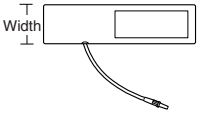
*** These Products Contain Natural Rubber Latex Which May Cause Allergic Reactions.**

Natural rubber may cause allergic reaction with symptoms such as itching, redness, urticaria, swelling, fever, dyspnea, symptoms similar to asthma, reduced blood pressure and shock. If the patient shows any of the above symptoms, immediately stop using the cuff and perform appropriate medical treatment.

Disposable Cuffs

CAUTION

- **Do not sterilize the non-sterilized disposable cuffs for neonates.**
- **Do not reuse disposable cuffs.**

Cuff			Width (cm)	Applicable circumference (cm)	Shape	Air Hose
Infants (Non-sterilized)		YP-910P	6	13 to 16		YN-100T (1.5 m) YN-101T (3.5 m)  Extension hose YN-990P (1.5 m)
Children (Non-sterilized)		YP-912P	9	19 to 22.5		
Adults (Non-sterilized)	Small	YP-913P	12	20 to 30		
	Standard	YP-914P	14	23 to 35		
	Large	YP-915P	16	30 to 40		
	Extra large	YP-916P	20	38 to 50		
Neonates (Non-sterilized)	#20	YP-920P	2.5	3 to 6		YN-120T (1.5 m) YN-121T (3.5 m) 
	#21	YP-921P	3	4 to 7.5		
	#22	YP-922P	4	5.5 to 10		
	#23	YP-923P	5	7 to 13		
Neonates (Sterilized)	No. 11	YP-111P*	3	5 to 7.5		
	No. 12	YP-112P*	4	7.5 to 10.5		
	No. 13	YP-113P*	5	8.5 to 13		

* These parts have not been checked for compliance with the MDD (Medical Device Directive). For EC member countries, Nihon Kohden recommends the use of parts that comply with MDD.

If necessary, sterilize the disposable cuffs for infants, children and adults using glutaraldehyde solution by following its instructions.

The non-sterilized disposable cuffs for neonates cannot be sterilized. If necessary, use sterilized disposable cuffs for neonates.

Disinfecting Disposable Cuffs before Use

If necessary, disinfect the cuffs before use. The disposable cuffs for neonates cannot be disinfected.

NOTE

Do not let water get inside the cuff. If water gets inside the cuff, use a new one.

1. Wipe the cuff with a cloth moistened with neutral soap water or isopropyl alcohol.

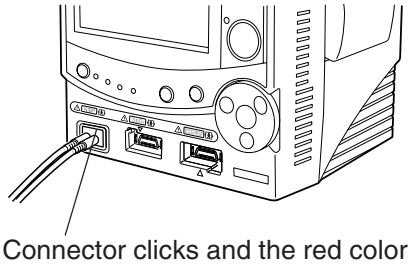
   When soap water is used, rinse the cuff thoroughly with water.

2. Immerse the cuff in a disinfectant solution. Refer to the disinfectant instructions.

3. Rinse the cuff thoroughly with a sterilized solution.

4. Dry the cuff at room temperature. Do not heat the cuff.

Connecting Cables and Attaching the Cuff to the Patient



Connector clicks and the red color of the NIBP socket is completely hidden behind the air hose connector

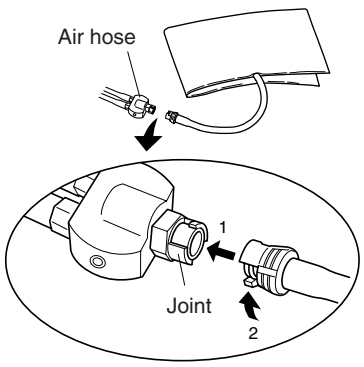
Connecting Air Hose and Cuff to the Monitor

CAUTION

Confirm that the air hoses are firmly connected between the socket and hoses of the cuff. If not connected properly (the air hose connector clicks and the red color of the NIBP socket is completely hidden behind the air hose connector when properly inserted into the socket), the cuff cannot be correctly identified and air leakage will cause incorrect NIBP data or no data.

NOTE

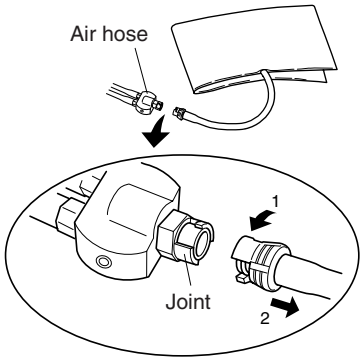
Before using the cuff, check and confirm that there is no flaw, crack or hole on the cuff. If the rubber cuff is cracked, has a hole or is not elastic, it may burst.



1. Connect the cuff to the air hose.

   Connecting the Cuff for Adults and Children

   Insert the cuff connector joint into the YN-100T/101T air hose and turn it clockwise until it clicks.



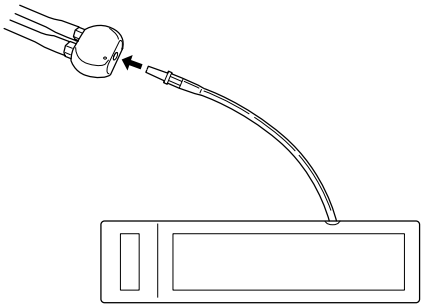
To disconnect the cuff from the air hose, turn the cuff connector joint counterclockwise to unlock it and remove it from the air hose.

NOTE

Do not apply excessive force to the joint, for example, stepping on it or pulling it with a clamp or pliers.

Connecting the Cuff for Neonates

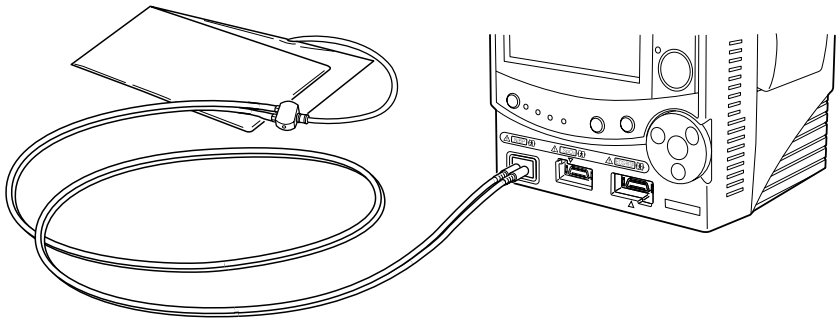
Insert the cuff connector joint into the YN-120T/121T air hose.



2. Connect the air hose to the NIBP socket on the monitor.

The monitor automatically identifies the type of the connected air hose (subject of measurement).

When Connecting the YP-953T Cuff for Adults



3. Check that the correct type of cuff is displayed on the monitoring screen.

When using the cuff for neonates, 🐼 appears on the screen. When using the cuff for adults or children, there is no panda mark on the screen.

Attaching the Cuff to the Patient

How to Wrap the Cuff

WARNING

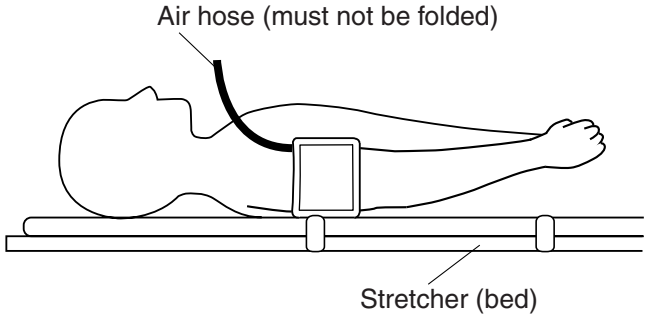
- **When attaching the cuff to a premature infant at an early stage after birth, periodically change the cuff position to avoid possible skin erosion and fissure.**
- **NIBP measurement on a sickle cell anemia patient may cause a thrombus.**

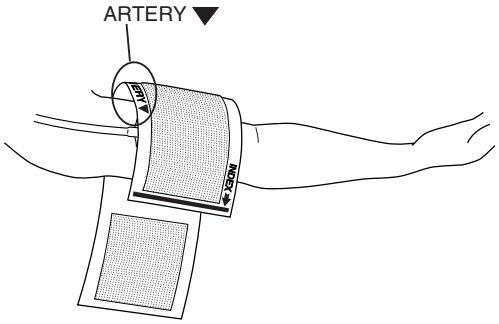
CAUTION

Do not wrap the cuff to the arm or thigh which is used for injection. NIBP measurement on an arm or thigh which is used for injection may cause a reflux of blood and stop injection.

When wrapping the cuff around the upper arm, observe the following points.

- The cuff must not wrap around the elbow.
- The cuff should just wrap around the upper arm, not too tightly or too loosely. A tightly wrapped cuff can cause discomfort to the patient and decreases pressure reading. A loosely wrapped cuff prolongs the measurement time and increases the blood pressure reading. If the cuff pressure does not increase, the monitor automatically stops inflating in 180 seconds (90 seconds when measuring a neonate) and stops the measuring procedure for patient safety.
- To prevent external vibration from affecting the measurement, the cuff and the cuff hoses should not touch the stretcher or the stretcher's railing. Use an elbow rest (any soft object) to support the cuffed arm naturally and to keep the cuff from touching the stretcher.
- The air hose must not be folded or kinked.
- In principle, the cuff should be wrapped around a bare upper arm. Thick clothing can damp the pulsatile oscillation of the cuff pressure. It is still possible to obtain a measurement if the cuff is wrapped around thin clothing over the upper arm.
- Measurement values at other sites differ from the values at the upper arm. When NIBP measurement is important, NIBP must be measured at the upper arm.



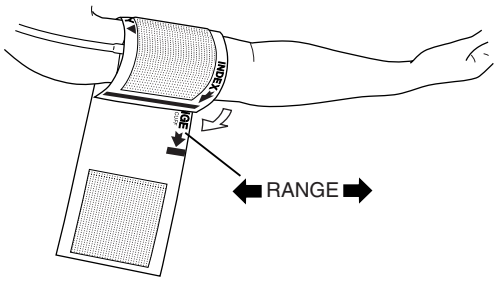


When Using the YP-950T/951T/952T/953T/954T/955T Reusable Cuffs

1. Put the cuff on the upper arm so that the ▼ mark of the "ARTERY ▼" aligns with the artery of the patient.

NOTE

The cuff must not wrap around the elbow.



2. Wrap the cuff so that the "INDEX ➡" comes within the "⬅ RANGE ➡".

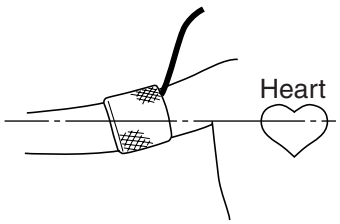
   If the "INDEX ➡" is not within the "⬅ RANGE ➡", change the cuff size.

Cuff Hose and Air Hose

Confirm that the hoses are not folded, kinked or squeezed.

CAUTION

When too much pressure is applied to the cuff, or the hose is folded or kinked, the "NIBP SAFETY VALVE OPEN" message appears on the screen and NIBP monitoring may be stopped. Remove the cause, wait for 40 seconds, check that the message disappears, then measure again.



Cuff Position (Height of Cuff from Heart Level)

Place the cuffed upper arm (brachium) at the same height as the patient's heart. If the cuff is not at the same level as the heart, the weight of the blood affects the blood pressure reading. The pressure difference per unit height is 0.7 mmHg/cm. The blood pressure reading decreases when the arm is higher than the heart and increases when lower.

The best measuring condition is when the patient is lying on his/her back with arms and legs relaxed. If the cuff position cannot be on the same level as the heart, the displayed blood pressure reading must be mathematically adjusted.

Changing NIBP Settings

NOTE

To change settings for monitoring neonate NIBP, the air hose for neonates must be connected to the NIBP socket.

The following settings can be changed for monitoring NIBP.

Setting Item	Setting Screen
NIBP systolic alarm limits	SYS on the ALARM window.
Measurement mode and interval selection*	INTERVAL on the NIBP window.
Measure NIBP when vital sign alarm occurs	ALARM MEAS on the NIBP window.
Automatic measurement with PWTT on/off and trigger threshold	ΔPWTT on the NIBP window.
NIBP measurement completion sound on/off	NIBP COMPLETED SOUND on the SYSTEM SETUP screen. Refer to Section 3.
Measurement mode after STAT measurement	NIBP MODE AFTER STAT on the SYSTEM SETUP screen. Refer to Section 3.
Time after NIBP measurement for the NIBP data to become dark	DIM OLD NIBP DATA on the SYSTEM SETUP screen. Refer to Section 3.
NIBP unit	PRESSURE UNIT on the SYSTEM SETUP screen. Refer to Section 3.
Initial cuff inflation pressure for adult and neonate	INIT CUFF PRESS on the SYSTEM SETUP screen. Refer to Section 3.

* To select the NIBP measurement mode from the mode selection, press the NIBP INTERVAL key on the front panel.

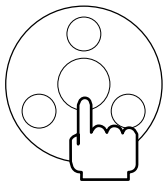
The settings on the SYSTEM SETUP screen must be changed before starting monitoring. To change settings on the SYSTEM SETUP screen, refer to Section 3.

Changing the NIBP Alarm Settings

CAUTION

When the upper or lower alarm limit is turned off, there will be no NIBP upper or lower alarm for that limit.

Set the upper and lower systolic NIBP alarm limits on the ALARM window.



1. From the monitoring screen, press the rotary dial center key on the front panel. The ALARM window opens.

2. Press the rotary dial center key to enter the ALARM window. The cursor moves to the "SYS" upper box.

3. Press the rotary dial center key to change the cursor color to blue, turn the rotary dial to select the systolic NIBP upper limit, and press the rotary dial center key to register the limit.

   Turn the rotary dial to move the cursor to the "SYS" lower box, press the rotary dial center key to change the cursor color to blue, turn the rotary dial to select the systolic NIBP lower limit, and press the rotary dial center key to register the limit.

	Setting Range (mmHg)	Initial Setting
Upper Limit (adult):	15 to 260, OFF (5/step)	180
Lower Limit (adult):	OFF, 10 to 255 (5/step)	80
Upper Limit (neonate):	10 to 125, OFF (5/step)	100
Lower Limit (neonate):	OFF, 5 to 120 (5/step)	50
	Setting Range (kPa)	Initial Setting
Upper Limit (adult):	1.5 to 35.0, OFF (0.5/step)	24.0
Lower Limit (adult):	OFF, 1.0 to 34.5 (0.5/step)	10.5
Upper Limit (neonate):	1.5 to 17.0, OFF (0.5/step)	13.5
Lower Limit (neonate):	OFF, 1.0 to 16.5 (0.5/step)	5.5

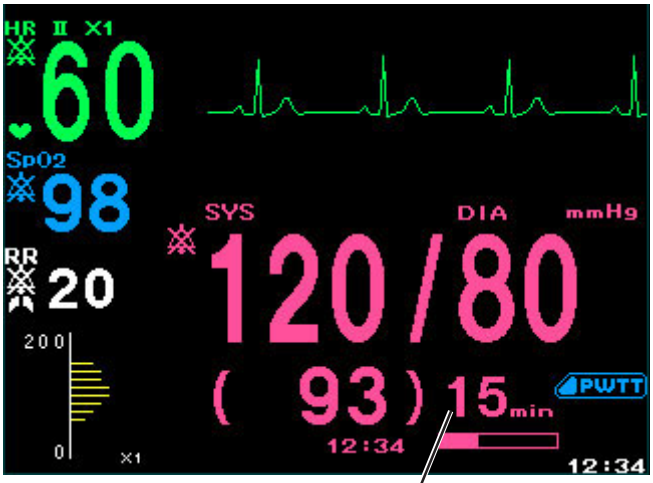
   If the upper limit is set to a value above the maximum or the lower limit is set to a value below the minimum, the alarm is set to OFF.

4. To return to the monitoring screen, select "CLOSE" on the ALARM window or press the HOME/REVIEW key on the front panel.

Selecting the Measurement Mode

Measurement Modes

The following measurement modes are available. The selected mode or interval is displayed below the NIBP measurement data on the monitoring screen.



Measurement mode

Manual Measurement

In Manual mode, a single NIBP measurement is performed when the ◇/▽ NIBP START/STOP key on the front panel is pressed.

STAT (Continuous) Measurement

WARNING

While performing STAT (continuous) measurements many times without a pause, periodically check the blood vessels and limb for adequate circulation.

In STAT mode, measurement is continuously repeated for 15 minutes after the ◇/▽ NIBP START/STOP key is pressed.

When the STAT measurement for 15 minutes is completed, the measurement mode automatically changes to the Manual mode or Auto mode at 1, 2, 2.5, 5, 10, 15, 30 minute, 1, 2 or 4 hour interval depending on the NIBP MODE AFTER STAT setting on the SYSTEM SETUP screen. The default setting is Manual mode. Refer to Section 3.

Auto Measurement

In Auto mode, measurement is performed automatically at the preset time intervals.

WARNING

When performing long term measurements at intervals less than 2.5 minutes, periodically check the state of the patient, blood vessels and limb for adequate circulation.

The actual measurement time is automatically timed from the next nearest selected interval. For example, if you start measurement at 9:02 with 5 min interval, the measurement will be performed at 9:05, 9:10, 9:15 and so on. If you start measurement at 10:35 with 60 min interval, the measurement will be performed at 11:00, 12:00, 13:00 and so on.

In the Auto mode, a single measurement can be performed by pressing the ◇/▽ NIBP START/STOP key on the front panel between auto measurements.

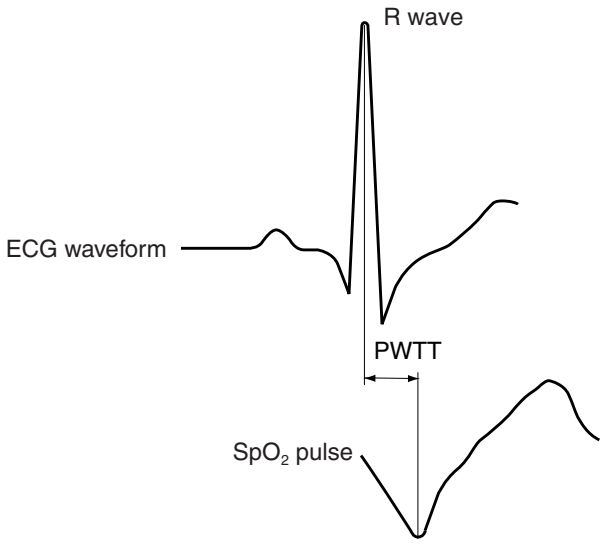
Automatic Measurement with PWTT

PWTT (pulse wave transit time) is a parameter which can indicate sudden change in blood pressure. PWTT is the interval between the R wave of the ECG and the onset of the SpO_2 pulse wave. In many cases, PWTT changes according to change in circulation. This PWTT change (delta PWTT) can be used to trigger NIBP measurement. When the delta PWTT exceeds a preset threshold, it triggers NIBP measurement. Therefore, PWTT can be used to monitor sudden critical changes in blood pressure which may go undetected by the usual periodic NIBP measurement.

CAUTION

- **Do not rely only on the PWTT to monitor blood pressure changes. When it is necessary to monitor critical blood pressure change, set the appropriate interval for NIBP measurement.**
- **When the delta PWTT threshold is too short for a patient, NIBP measurement may be performed too frequently. If this occurs, change the delta PWTT threshold to a longer time.**
- **The PWTT may be incorrect when there is too much arrhythmia or noise.**
- **In the following cases, PWTT may trigger too many or no NIBP measurements. Check the patient condition. If necessary, change the delta PWTT threshold or set PWTT to Off.**
  - **Rapid blood pressure change with vasoreflex due to vasoactive drugs, such as phenylephrine and nicardipine.**
  - **Unstable pulse wave due to poor peripheral circulation.**
  - **Too many arrhythmias.**
  - **Patient movement.**
  - **Noise on ECG due to ESU.**
  - **SpO_2 measurement on foot of a child.**
- **Do not measure NIBP with PWTT on a neonate because circulation of a neonate changes rapidly.**

To use PWTT in automatic NIBP measurement, you must set the delta PWTT threshold on the NIBP window and the NIBP measurement mode to one of the intervals. NIBP measurement with PWTT can only be set when the cuff for adult or child is connected to the monitor. To change settings for PWTT, refer to the "Changing the PWTT Settings" section. NIBP is measured at the selected interval and when the delta PWTT exceeds the preset threshold.



NOTE

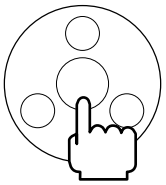
NIBP measurement with PWTT can only be performed when the cuff for adult or child is connected to the monitor, NIBP measurement mode is set to one of the intervals and ECG and SpO_2 are monitored.

When automatic measurement with PWTT is set to ON, the delta PWTT mark is displayed below the NIBP data on the monitoring screen. The delta PWTT mark appears in blue when the delta PWTT threshold is set, the NIBP measurement mode is set to one of the interval and ECG and SpO_2 are monitored. The delta PWTT mark appears in grey when delta PWTT threshold is set but ECG or SpO_2 connection cord is not connected, or the NIBP measurement mode is either manual or STAT.

"PWTT" is displayed in the MEMO column on the list window when measured with PWTT.

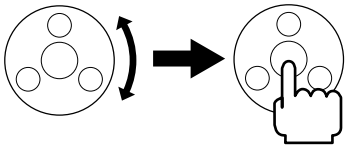
Selecting the Measurement Modes for the Mode Selection

When the NIBP INTERVAL key on the front panel is pressed, the measurement mode below the NIBP data on the monitoring screen changes according to the modes selected at INTERVAL on the NIBP window. MANUAL mode is already selected for the mode selection.

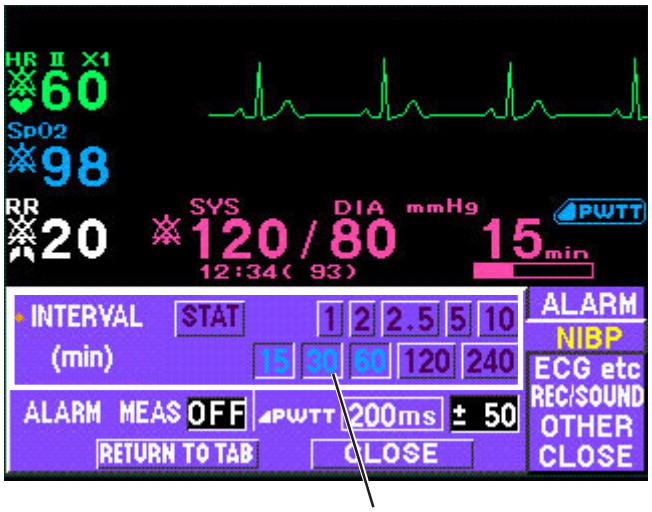


To select the modes for the mode selection:

1. From the monitoring screen, press the rotary dial center key on the front panel. The ALARM window opens.



2. Turn the rotary dial to select “NIBP” and press the rotary dial center key to enter the NIBP window. The cursor moves to the “INTERVAL” box.



Selected interval or mode is depressed

3. To select the modes, move the cursor to the desired mode by turning the rotary dial and press the rotary dial center key to depress the button (blue). Select all the modes that you want to set for the mode selection.

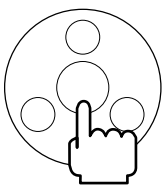
4. To return to the monitoring screen, select “CLOSE” on the NIBP window or press the HOME/REVIEW key on the front panel.

Changing the PWTT Settings

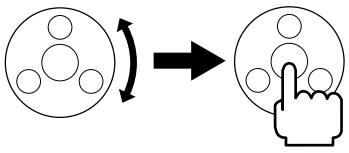
You can select automatic NIBP measurement with or without PWTT. When PWTT is set to on, you can also select the delta PWTT threshold for triggering NIBP measurement.

To trigger NIBP measurement with a smaller change in blood pressure, set the delta PWTT threshold to a shorter time.

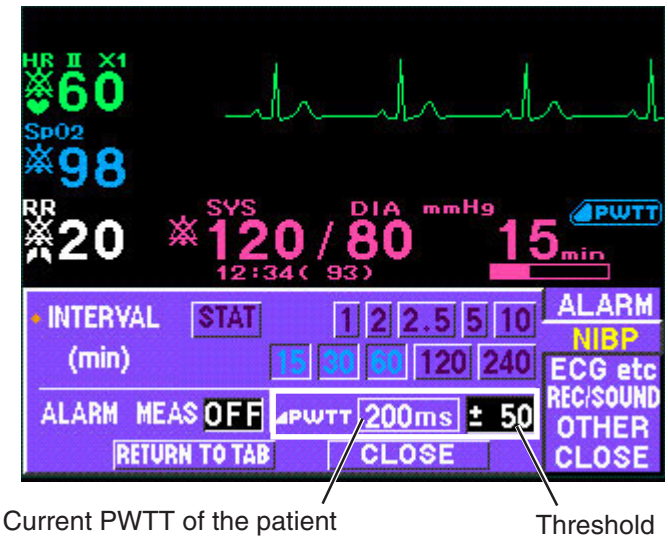
If NIBP measurement is performed too frequently, set the delta PWTT threshold to a longer time.



1. From the monitoring screen, press the rotary dial center key on the front panel. The ALARM window opens.



2. Turn the rotary dial to select “NIBP” and press the rotary dial center key to enter the NIBP window. The cursor moves to the “INTERVAL” box.



3. Turn the rotary dial to move the cursor to the “delta PWTT” box, press the rotary dial center key to change the cursor color to blue, turn the rotary dial to select the threshold, and press the rotary dial center key to register the setting. When “OFF” is set, the NIBP measurement with PWTT is register to OFF.

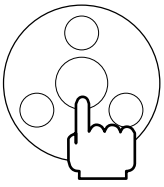
4. To return to the monitoring screen, select “CLOSE” on the NIBP window or press the HOME/REVIEW key on the front panel.

Setting NIBP Measurement on Vital Sign Alarm Occurrence

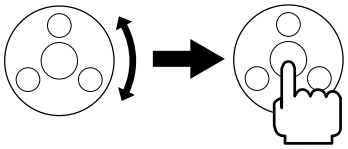
NIBP measurement can be performed when a vital sign alarm occurs to check the NIBP value.

NOTE

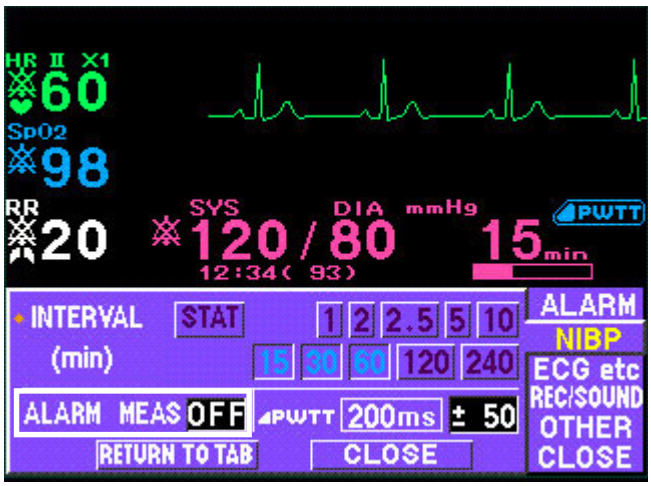
Remeasurement is not performed on systolic alarm occurrence of the remeasurement.



1. From the monitoring screen, press the rotary dial center key on the front panel. The ALARM window opens.



2. Turn the rotary dial to select “NIBP” and press the rotary dial center key to enter the NIBP window. The cursor moves to the “INTERVAL” box.



3. Turn the rotary dial to move the cursor to “ALARM MEAS” and press the rotary dial center key to select ON or OFF.

4. To return to the monitoring screen, select “CLOSE” on the NIBP window or press the HOME/REVIEW key on the front panel.

Measuring and Monitoring NIBP

When the preparation is done properly, you can start non-invasive blood pressure measurements.

WARNING

When performing long term measurements at intervals less than 2.5 minutes, periodically check the state of the patient, blood vessels and limb for adequate circulation.

CAUTION

- **When the "AIR HOSE OFF" message appears on the screen, connect the air hose to the socket properly. NIBP cannot be monitored and the alarm does not function properly while this message is displayed.**
- **When too much pressure is applied to the cuff, or the hose is folded or kinked, the "NIBP SAFETY VALVE OPEN" message appears on the screen and NIBP monitoring may be stopped. Remove the cause, wait for 40 seconds, check that the message disappears, then measure again.**

NOTE

- **When measuring patients who are conscious, help the patient to relax. Measurement may not be accurate if the patient's arm is tense or if the patient talks.**
- **The data for measurement on the thigh tends to be higher than measurement on the arm.**
- **Do not apply pressure to the cuff or air hose. NIBP may not be measured correctly because of the noise or NIBP measurement may stop due to the NIBP safety circuit running.**

For error messages and monitoring problems, refer to Section 11.

Recommended Patient State

Keep the patient quiet and maintain the patient's arm in a relaxed position during NIBP measurement so that measurement can be done under optimal conditions.

Starting and Stopping NIBP Measurement

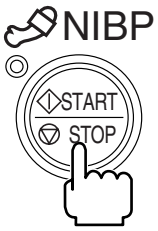
Select the measurement mode by pressing the NIBP INTERVAL key on the front panel. The measurement mode changes according to the modes selected on the "INTERVAL" on the NIBP window every time the key is pressed. Refer to the "Selecting the Measurement Modes for Mode Selection" section.

When STAT or auto mode is selected, the STANDBY message is displayed indicating that the monitor is waiting for the NIBP START/STOP key to be pressed.

NOTE

After NIBP measurement, the next measurement cannot start until the cuff pressure is less than 10 mmHg (2 mmHg in the NEONATE mode) for more than 3 seconds.

During NIBP measurement, the NIBP lamp on the front panel lights.



Manual Mode

To start the NIBP measurement in the Manual mode, press the NIBP START/STOP key. The single measurement starts and automatically stops. To cancel it, press this key again during measurement.

STAT (Continuous) Mode

To start the NIBP measurement in STAT mode, press the NIBP START/STOP key. The measurement will be continuously repeated for 15 minutes. To stop (cancel) it within the 15 minutes, press this key again.

After completing the STAT measurement, the measurement mode changes to the mode set on "NIBP MODE AFTER STAT" on the SYSTEM SETUP screen. Refer to Section 3.

Auto Mode

The Auto mode works when one of the time intervals is selected.

The first NIBP measurement is performed when the NIBP START/STOP key is pressed. The second measurement is performed when the current time (minutes) in the monitor reaches the nearest time interval selected. Refer to the "Selecting the Measurement Mode" section.

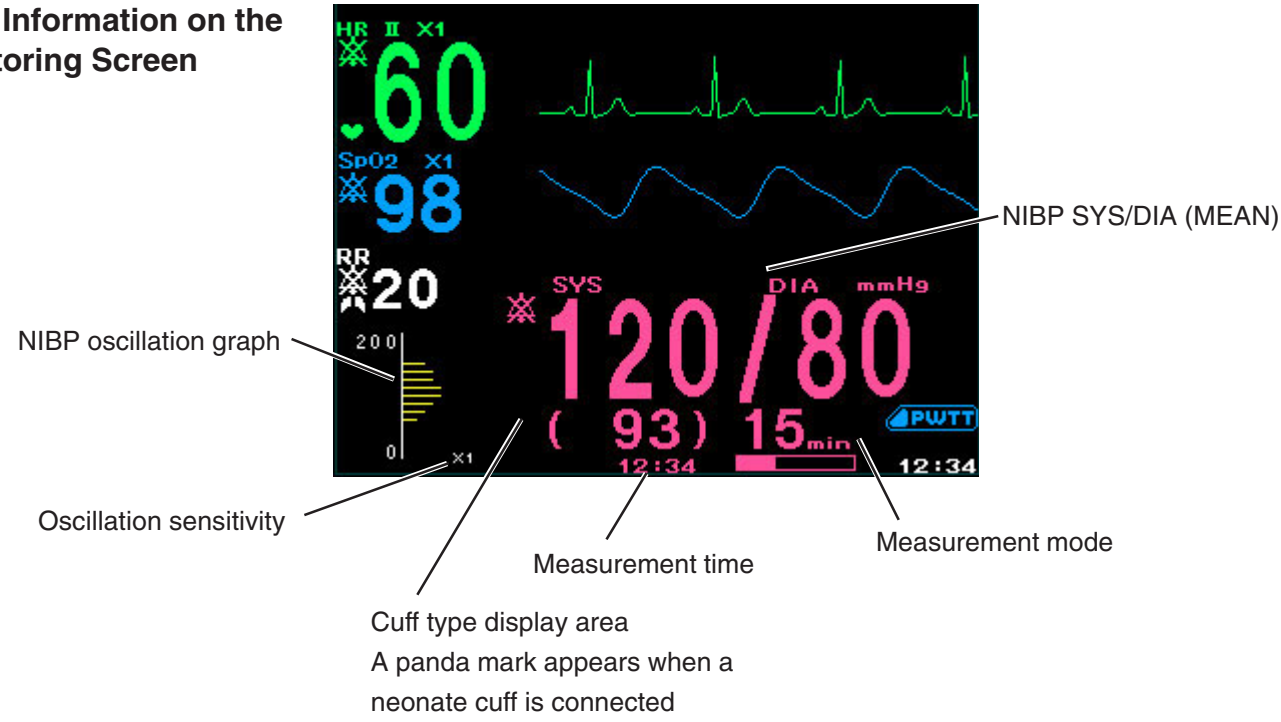
When PWTT trigger threshold is set on the NIBP window, NIBP is automatically measured when the PWTT exceeds the threshold. Refer to the “Changing the PWTT Settings” section.

To stop NIBP measurement in auto mode, change the mode to Manual.

To cancel one measurement, press the ◇/▽ NIBP START/STOP key during the measurement.

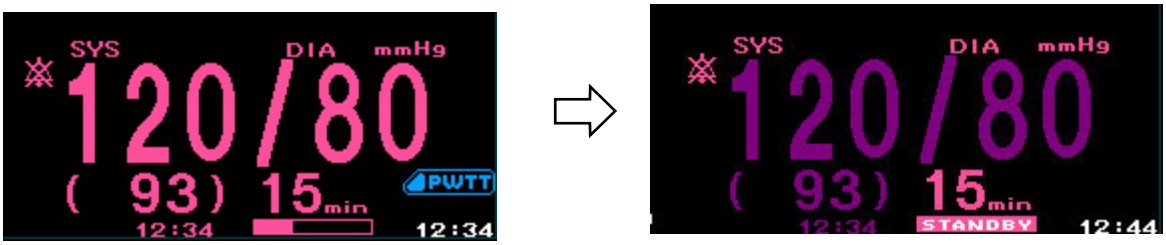
To perform a single measurement in this mode, press the ◇/▽ NIBP START/STOP key once between auto measurements.

NIBP Information on the Monitoring Screen



When NIBP Data Becomes Dim

When the time set at DIM OLD NIBP DATA on the SYSTEM SETUP screen elapses after the last measurement, the NIBP data on the monitoring screen becomes dim.



NIBP Pulse Rate Display

The NIBP pulse rate is displayed on the monitoring screen when only NIBP is monitored and the sync source is set to AUTO. The NIBP pulse rate is updated at each NIBP measurement. There is no sync sound when the sync source is NIBP.

When the NIBP pulse rate is monitored, the NIBP pulse rate is listed in the PR/HR column on the list window and is displayed as the HR trendgraph on the trendgraph window.

Section 11 Error Messages and Troubleshooting

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Monitoring

Message or Trouble	Possible Cause/Criteria	Action
LOW BATTERY message	Battery is fully discharged.	Replace the battery with a fully charged battery or use AC power.
The screen is dark.	The backlight is old.	Contact your Nihon Kohden distributor.
	The monitor is operating on battery.	Operate on AC power if the screen is too dark.
No sync sound.	The sync sound volume is turned down.	Adjust the volume setting on the REC/SOUND window. Refer to Section 4.
	The sleep mode is turned on.	The sleep mode is turned off when: • alarm occurs (when EXIT SLEEP MODE ON ALARM is set to YES on the SYSTEM SETUP screen) • key on the front panel is pressed
The time displayed on the lower right corner of the screen is not correct.	The date and time setting is not correct.	Set the correct date and time on the OTHER window. Refer to Section 2.
	The backup battery is old.	Check the date and time setting on the OTHER window and turn the monitor power off and on. If the time is incorrect, replace the backup battery with a new one. Contact your Nihon Kohden distributor.
The monitor is too hot.	The vent hole is obstructed.	Remove the cause.

Recording (When Using an Optional Recorder Unit)

Messages

Screen Message	Possible Cause/Criteria	Action
RECORDER DOOR OPEN	The recorder door is open.	Push the recorder door closed until it clicks.
OUT OF PAPER	No recording paper.	Load the recording paper. Refer to Section 2.
	The recording paper is not loaded correctly.	Correctly load the recording paper. Refer to Section 2.
	Data is recorded.	To stop recording, press the record key on the front panel.

Problems

Trouble	Possible Cause/Criteria	Action
There is no recording (only paper feeding).	The recording paper is upside down.	Reload the recording paper into the recorder correctly. Refer to Section 2.
Recorder operates only some of the time.	Dust in the sensor inside the recorder.	Clean the surface of the sensor inside the recorder with a dry cotton swab.
Recording is faint.	The specified paper is not used.	Use the QW60-2 recording paper.
	The thermal head is dirty.	Clean the thermal head with the provided thermal head cleaning pen. Refer to Section 12.
Dots are missing.	The thermal head is dirty.	Clean the thermal head with the provided thermal head cleaning pen. Refer to Section 12.
Recording suddenly starts without key operation.	Alarm recording or auto list recording mode is set to ON.	Set the alarm recording or auto list recording mode on the REC/SOUND window to OFF if not needed. Press the record key on the front panel to stop recording.
No paper is feeding.	The recorder door is open.	Push the recorder door closed until it clicks.
	Dust may have collected in the gears.	Contact your Nihon Kohden distributor.

ECG Monitoring

Messages

Screen Message	Possible Cause/Criteria	Action
CHECK ELECTRODE	The electrode lead is detached from the electrode.	Connect the electrode lead to the electrode firmly.
	The electrode cannot be attached firmly to the skin.	Replace the electrode with a new one.
	The electrode lead is disconnected from the ECG connection cord.	Connect the electrode lead to the ECG connection cord.
	The contact between the lead and electrode is poor.	Clean the electrode lead clip or replace the electrode lead with a new one.
	The electrode lead is damaged.	Replace the electrode lead with a new one.
	Differential offset voltage at electrodes.	Replace the electrode with a new one.
ECG CONNECTOR OFF	The ECG connection cord is disconnected from the ECG socket.	Connect the ECG connection cord properly. When ECG monitoring is not necessary, press the SILENCE ALARM key to silence the alarm.
	The ECG connection cord is damaged.	Replace the ECG connection cord with a new one.
ECG NOISE	The baseline is not stable due to respiration or body movement.	Change the electrode position.
	EMG noise is superimposed.	Change the electrode position to where there is less muscle.
	The electrode is pulled by the lead.	Put some slack into the electrode lead.
	The electrode is dry.	Replace the electrode with a new one.
	The contact between the lead and electrode is poor.	Clean the electrode lead clip or replace the electrode lead with a new one.
	High electrode impedance.	Rub the skin with “skinPure” skin preparation gel.
	An electric blanket is used.	Use another warming method.
	Equipment which emits strong electromagnetic interference is nearby. e.g. ESU, cellular phone.	Keep the interference source away from the monitor or turn off the emitter source power. When using the ESU, refer to “Use with an Electrosurgical Unit” in Section 7.
	No equipotential grounding is not acquired.	Connect the equipotential ground terminal on the monitor to the equipotential ground terminal on the wall with the grounding lead.
Pacing pulses are displayed (When PACING DETECT is set to ON on the ECG etc window.)	Pacing spike is detected.	When the patient does not have an implanted cardiac pacemaker, set the PACING DETECT to OFF on the ECG etc window.
	An electric blanket is used.	Use another warming method.
	ECG of a neonate is monitored.	Set the PACING DETECT to OFF on the ECG etc window.

Problems

Trouble	Possible Cause/Criteria	Action
The heart rate is inaccurate.	The QRS amplitude is small.	Change the sensitivity so that the QRS amplitude is larger than 1 cm.
	The QRS is not detected correctly.	Change to a lead which provides good QRS.
		Change the lead or electrode position so that the QRS is large and T wave is small.
	The PACING DETECT setting on the ECG etc window is not appropriate.	When the patient does not have an implanted cardiac pacemaker or neonate's ECG is monitored, set the PACING DETECT to OFF.
AC interference on the ECG waveform.	An electrical blanket is used.	Use another warming method or place a shield cover around the electrical blanket.
	The electrode is dry.	Replace the electrode with a new one.
	AC LINE NOISE FILTER on the SYSTEM SETUP screen is set to OFF.	Set AC LINE NOISE FILTER to ON.
Baseline wandering.	The baseline is not stable due to respiration or body movement.	Change the electrode position to where there is less muscle.
	The electrode is dry.	Replace the electrode with a new one.
	The contact resistance between the skin and electrode is high.	Rub the skin with "skinPure" skin preparation gel.
	DRIFT FREE FILTER on the SYSTEM SETUP screen is set to OFF.	Set DRIFT FREE FILTER to ON.

Respiration Monitoring

Messages

Screen Message	Possible Cause/Criteria	Action
APNEA	Apnea exceeded the apnea alarm limit.	————
	Respiration waveform cannot be detected because the sensitivity is too low.	Set the sensitivity so that the respiration amplitude is larger than 1 cm.
CHECK ELECTRODE	The electrode lead is detached from the electrode.	Connect the electrode lead to the electrode firmly.
	The electrode cannot be attached firmly to the skin.	Replace the electrode with a new one.
	The electrode lead is disconnected from the ECG connection cord.	Connect the electrode lead to the ECG connection cord.
	The contact between the lead and electrode is poor.	Clean the electrode lead clip or replace the electrode lead with a new one.
	The electrode lead is damaged.	Replace the electrode lead with a new one.
	Differential offset voltage at electrodes.	Replace the electrode with a new one.
ECG CONNECTOR OFF	The ECG connection cord is disconnected from the ECG socket.	Connect the ECG connection cord properly. When respiration monitoring is not necessary, press the SILENCE ALARM key to silence the alarm.
RESP NOISE	Noise on the respiration waveform.	Check the electrode attachment.
RESP OFF	Respiration monitoring is set to OFF.	When monitoring respiration is necessary, set RESP SENS to one of the setting on the ECG etc window.

Problems

Trouble	Possible Cause/Criteria	Action
The respiration rate is not counted.	Respiration monitoring is set to OFF.	Set the respiration sensitivity to one of the settings on the ECG etc window.
	Electrodes, electrode leads and ECG connection cord are not connected correctly.	Connect them properly.
	The electrode is dry.	Replace the electrode with a new one.
	The skin-electrode contact impedance is high.	Reduce the impedance by using “skinPure” skin preparation gel.
The respiration waveform and respiration rate are not stable.	The electrode positions are not appropriate for measuring respiration.	Check the attached position of the electrodes.
	The electrode is dry.	Replace the electrode with a new one.
The respiration rate is not accurate.	The respiration waveform amplitude is too small.	Change the sensitivity so that the amplitude is larger than 1 cm.

SpO_2 Monitoring

Messages

Screen Message	Possible Cause/Criteria	Action
	Too much body movement.	When the message is displayed frequently, check the patient condition and, if necessary, change the attachment site.
	The probe is not attached to the patient properly.	
SpO2 CANNOT DETECT PULSE	The pulse waveform is not stable and SpO2 value cannot be measured.	Attach the probe to the patient properly.
	Poor blood circulation for measuring SpO2.	Check the patient condition, probe attachment or change the attachment site.
	The probe is not attached to the patient properly.	Attach the probe to the patient properly.
SpO2 CHECK PROBE	The probe cable is disconnected from the SpO2 connection cord.	Connect the probe cable to the SpO2 connection cord. If SpO2 monitoring is not necessary, press the SILENCE ALARMS key.
SpO2 NO PROBE	The probe is not attached to the patient properly.	Attach the probe to the patient properly.
	SpO2 connection cord is damaged.	Replace the SpO2 connection cord with a new one.
SpO2 CHECK PROBE SITE	The probe is not attached at the appropriate site.	Attach the probe to a site 6 to 14 mm thick.
	The probe has expired.	Replace the probe with a new one.
SpO2 CONNECTOR OFF	The SpO2 connection cord is disconnected from the SpO2 socket.	Connect the SpO2 connection cord properly. When SpO2 monitoring is not necessary, press the SILENCE ALARM key to silence the alarm.
	SpO2 connection cord is damaged.	Replace the SpO2 connection cord with a new one.
SpO2 LIGHT INTERFERECE	A surgical light, bilirubin lamp, or sunlight is close to the probe.	Cover the attachment site with a blanket.
SpO2 MODULE FAILURE	SpO2 hardware malfunction.	Turn off the monitor power, wait for a few minutes and turn on the power again. If the message still appears, contact your Nihon Kohden distributor.
SpO2 PROBE FAULT	Probe is expired.	Replace the probe with a new one.
	Probe is damaged or short-circuited.	Replace the probe with a new one.
	SpO2 connection cord is damaged.	Replace the SpO2 connection cord with a new one.
SpO2 SEARCHING PULSE	Searching for the correct pulse wave.	Wait until the pulse wave is detected.
	The probe attachment site is not appropriate.	Attach the probe to an appropriate place.
	Poor blood circulation for measuring SpO2.	Check the patient condition, probe attachment or change the attachment site.
	The probe is secured too tightly and it is obstructing the blood circulation.	Reattach the probe.
	The probe is disconnected from the SpO2 connection cord.	Connect the probe to the SpO2 connection cord.
	The finger probe is not attached to the patient properly.	Attach the finger probe firmly to the patient.
SpO2 WEAK PULSE	Poor peripheral circulation.	Check the patient condition and change the attachment site.
	The probe is attached too tightly and is obstructing the blood circulation.	Reattach the probe.

Problems

Trouble	Possible Cause/Criteria	Action
Unstable SpO_2 value.	The probe size is inappropriate.	Use the correct size probe.
	The probe is attached to the same limb that is used for NIBP or IBP measurement.	Attach the probe to the other limb.
	An ESU is used.	Locate the ESU as far as possible from the probe and wait until the pulse wave stabilizes.
	Measuring on the venous pulse.	Cannot measure correctly. Attach the probe to the site where there is no venous pulse.
SpO_2 value on the monitor and CO oximeter do not match.	The probe is not attached properly.	Attach the probe correctly. (The emitter and detector of the probe must face each other.)
	The attachment site is inappropriate.	Attach the probe to a site 6 to 14 mm thick.
	The measuring site is not clean.	If necessary, remove nail polish and clean the measuring site.
	Too much abnormal hemoglobin (HbCO, MetHB, etc.).	Cannot measure correctly. Refer to the value on the CO oximeter.
	Dye (methylene blue or indocyanine green) is injected in the blood.	Cannot measure correctly when there is dye in the blood. Wait for the dye to disappear from the blood.
	Measuring during CPR.	Cannot measure correctly. Monitor SpO_2 after CPR is finished.
Probe is damaged.	Probe was disinfected by an unspecified procedure.	Disinfect the probe using the specified method.
	The probe is repeatedly used.	Replace the probe with a new one when the expiration date passes.
Sine wave noise on the pulse wave	Light interference.	Cover the attachment site with a blanket.
	The line frequency setting on the monitor is not correct.	Set the correct line frequency on the SYSTEM SETUP screen.

NIBP Monitoring

Messages

Screen Message	Possible Cause/Criteria	Action
AIR HOSE OFF	The air hose is disconnected from the NIBP socket.	Connect the air hose properly. When NIBP monitoring is not necessary, press the SILENCE ALARM key to silence the alarm.
	The air hose is damaged.	Replace the air hose with a new one.
AIR LEAK	The cuff pressure does not change after inflation even after a certain period of time.	Connect the cuff to the air hose properly.
		Connect the air hose to the socket properly.
	The cuff or air hose is damaged.	Replace the cuff or air hose with a new one.
CUFF OCCLUSION	The cuff pressure does not decrease after measurement has completed.	Check that the air hose is not bent or squeezed.
HIGH CUFF PRESS	Excessive pressure was applied by the cuff.	When measuring an adult, ask the patient not to move too much.
INFLATION PRESS LOW	Insufficient cuff inflation pressure.	Wait until the cuff pressure rises.
NIBP CHECK INTERVAL	Auto measurement at 1 minute interval is performed for more than 30 minutes.	Check the patient condition for continuing the NIBP measurement.
NIBP HARDWARE ERROR	Hardware malfunction.	Contact your Nihon Kohden distributor.
NIBP MEAS TIME-OUT	The measuring time exceeded the specified time due to arrhythmia or noise.	If the cause is arrhythmia, measure by invasive blood pressure measurement. Remove the cause if due to noise.
NIBP NOISE	Noise detected during NIBP measurement.	Remove the cause, such as body movement.
NIBP NO PULSE	The patient's pulse wave is small.	Measure by palpation or invasive blood pressure method.
	The cuff is not attached to the patient correctly.	Wrap the cuff around the arm of the patient properly.
NIBP RE-MEASURING (Remeasurement is automatically performed. If the message still appears, after remeasurement, do the counter actions.)	The cuff is not attached to the patient.	Attach the cuff to the patient.
	Patient moved during measurement.	Wait for the patient to stop moving, then measure again.
	Patient's pulse is too small.	Measure by palpation or the invasive blood pressure method.
	The cuff is not attached properly.	Attach the cuff properly.
	The cuff size is not appropriate.	Check that the cuff of the correct size is used.
	Patient's pulse and heart rate is unstable.	Wait for the patient to relax and stop moving.
NIBP SAFETY VALVE OPEN (When this message is displayed, measurement cannot be performed for 40 seconds.)	The measurement is stopped by the safety circuit of the monitor.	Check that the hose is not bent or squeezed.
		Wait for 40 seconds before remeasurement. If the message still appears, contact your Nihon Kohden distributor.
NIBP WEAK PULSE	The patient's pulse wave is too small.	Measure by palpation or the invasive-blood pressure method.
	The cuff is wrapped too loosely.	Wrap the cuff around the arm properly.
	The cuff size is inappropriate.	Use the appropriate cuff.
NIBP ZEROING	NIBP zero balance adjustment is being performed.	Do not touch the cuff during zeroing and wait for the message to disappear.
STANDBY	NIBP measurement in auto or STAT mode is set and waiting for the NIBP START/STOP key to be pressed.	Press the NIBP START/STOP key to start measurement.
SYSTOLIC OVER	The maximum blood pressure exceeded 290 mmHg when using the adult cuff, or 125 mmHg when using the neonate cuff.	Measure by palpation or the invasive blood pressure method.

Problems

Trouble	Possible Cause/Criteria	Action
Cuff inflation pressure is less than 10 mmHg.	The air hose is not connected to the cuff socket properly.	Connect the air hose to the socket properly.
	The cuff is not wrapped around the arm or is wrapped too loosely.	Wrap the cuff around the upper arm.
The cuff does not inflate when the NIBP START/STOP key is pressed.	The air hose is not connected to the cuff socket.	Connect the air hose to the socket firmly.
	The cuff hose or air hose may be folded or squeezed.	Check the cuff hose and air hose.
Abnormal measurement results are displayed.	The cuff size is not correct.	Select the cuff which fits the patient's limb circumference.
	The cuff is not wrapped around the arm correctly.	Wrap the cuff around the upper arm, not too tightly or too loosely.
	NIBP data is not correct because of body movement.	Prevent the patient from moving during measurement.
	The cuff is touched during measurement.	Do not touch the cuff during measurement.
The cuff is suddenly deflated during inflation.	The NIBP START/STOP key is pressed during inflation.	———
Auto measurement does not start even when the time interval has passed.	The time interval for the NIBP auto measurement is changed.	Check the time interval.
The cuff suddenly inflates.	The measurement mode is set to auto mode.	Check the time interval.
	NIBP measurement is triggered by PWTT.	Set PWTT to OFF on the NIBP window when NIBP measurement with PWTT is not necessary.
Cannot connect cuff to the air hose.	Unspecified cuff is used.	Use a cuff specified by Nihon Kohden.
Cannot measure NIBP.	Noise which disables calculation of the blood pressure has interfered.	Remove the cause. Do not touch the cuff during measurement.
	The pulse wave is unstable due to arrhythmia.	Ask the patient not to move too much and perform invasive blood pressure measurement as required.
	The air hose is bent or squeezed.	Remove the cause.
	The cuff has worn out.	Use a new cuff.
Blood congestion occurs.	Measuring over a long period of time at intervals less than 2.5 minutes.	Increase the measuring interval.
		Do not measure NIBP over a long time.
Thrombus occurs.	Measuring a sickle anemia patient.	Do not perform NIBP measurement on a sickle anemia patient.
NIBP data on the screen is dark.	The time set at DIM OLD NIBP DATA on the SYSTEM SETUP screen elapsed from the last measurement.	When NIBP is measured again, the data is displayed in normal brightness.
Buzz sounds when the NIBP START/STOP key is pressed and cannot measure NIBP.	The NIBP START/STOP key is pressed before the cuff inflation pressure has deflated enough or during NIBP measurement stop interval (2 or 30 seconds).	Wait for the NIBP measurement stop interval to elapse before remeasurement.

Section 12 Maintenance

Handling Accessories After Use 12.2
Battery Pack 12.2
Battery Lifetime 12.2
Replacing Battery Pack 12.2
Disposal of Battery Pack 12.2
ECG and Respiration 12.2
Electrode Lifetime 12.2
Disposing of Electrodes 12.2
Cleaning and Disinfecting the Electrode Lead and ECG Connection Cord 12.2
SpO_2 ..... 12.3
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This section explains how to clean and care for your monitor to ensure reliability and many years of excellent operating condition. Cleaning and disinfecting probes, cuffs and cables are also explained in this section.

CAUTION

- **Do not disassemble the monitor. Disassembly must be performed by a qualified service personnel.**
- **Fuses should be replaced by qualified service personnel.**

Handling Accessories After Use

Battery Pack

Battery Lifetime

The battery pack can be used for about 300 cycles of full discharging/charging.

Replacing Battery Pack

Replace the battery pack with a new one after 300 cycles of discharging/charging or after one year whichever comes first.

When BATTERY EXPIRATION ALERT is set to ON and the battery replaced date is set on the SYSTEM SETUP screen, the “INSERT NEW BATTERY” message is displayed at the monitor power on one year after the replaced date. Refer to Section 3.

Replacement should be performed by a qualified service personnel.

Disposal of Battery Pack

Before disposing of the battery, check with your local solid waste officials for details in your area for recycling options or proper disposal. The battery is recyclable. At the end of its useful life, under various state and local laws, it may be illegal to dispose of this battery into the municipal waste stream.

ECG and Respiration

Electrode Lifetime

Replace the electrodes with new ones every 48 hours. Otherwise the contact impedance between the skin and electrode may increase due to drying of the electrode gel and correct measurement cannot be obtained.

If electrode contact becomes poor, replace it with a new one.

Disposing of Electrodes

Follow your local laws for disposing of medical waste.

Cleaning and Disinfecting the Electrode Lead and ECG Connection Cord

NOTE

- **Do not touch the connector pin.**
- **Do not wet the connector.**

Cleaning

Wipe the electrode lead and ECG connection cord with a soft cloth moistened with neutral soap, water or alcohol and wipe with a dry cloth or gauze.

Disinfecting

To disinfect the electrode lead and ECG connection cord, wipe them with a non-abrasive cloth moistened with any of the disinfectants listed below. Use the recommended concentration.

Disinfectant	Concentration (%)
Chlorohexidine gluconate solution	0.5
Benzethonium chloride solution	0.2
Glutaraldehyde solution	2.0
Benzalkonium chloride	0.2
Hydrochloric alkyldiaminoethylglycine	0.5

SpO_2

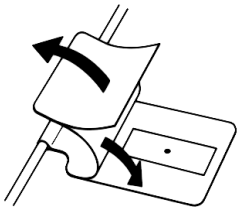
NOTE

For details, refer to the probe manual.

Expiration of Probes

CAUTION

- **Do not use the probe over its stated lifetime. Otherwise the SpO_2 measurement accuracy cannot be guaranteed.**
- **Do not use disposable probes for other patients. If the probe is dirty with blood or bodily fluids, replace it with a new one.**



- **Reusable Probes**

  Do not use the probe for more than one year after opening the package. If the hours are recorded, you can use the probe for up to 6,000 hours. The date of manufacture is stamped on the probe connector. When the package is opened, write the date on the cable tag. Remove the backing and apply the film.

Warranty for reusable probe

Nihon Kohden Corporation (NKC) shall warrant this probe against all defects in materials and workmanship for a period of 6 months after package is opened. NKC or its authorized agents will repair or replace any probe which proves to be defective during the warranty period, provided the probe is used in accordance with the operator's manual.

When using TL-201T probe

To know the degree of probe deterioration, check the signal level of the new TL-201T probe when you start to use it. Use the signal level sheet at the end of this manual. Replace the probe with a new one when the signal level becomes half of the level at the first use. For details on how to check the signal level, refer to the service manual.

- **Disposable Probes**
  Replace the probe with a new one every 32 hours. Otherwise, accurate measurement cannot be continued. If the probe is dirty with blood or bodily fluids, replace the probe with a new one.

Disposing of Probes

Follow your local laws for disposing of medical waste.

Cleaning, Disinfecting and Sterilizing the TL-201T Finger Probe

Cleaning

CAUTION

- **Do not use creosol soap, glutaraldehyde, sodium hypochlorite, or benzalkonium chloride because they damage the probe.**
- **Clean the probe after every use. Otherwise the probe deteriorates.**

Wipe the probe and cable with a soft cloth or cotton swab moistened with 70% alcohol solution. Dry the probe and cable thoroughly.

Disinfecting

CAUTION

- **Do not wet the connector with disinfectants or water. If it gets wet, thoroughly wipe it. Do not use the probe with the connector wet.**
- **Do not use Hibitane alcohol for disinfection. It may deteriorate the resin.**
- **Bodily fluids and disinfectants remaining in the probe will deteriorate the rubber part of the probe. Replace the probe with a new one if it gets deteriorated.**

To disinfect the probe, soak the probe in either of the disinfectants below. For the procedure, refer to the disinfectant manual. Use the recommended concentration.

- Glutaraldehyde solution 2.0%
- Hydrochloric alkyldiaminoethylglycine 0.5%

After disinfection, wash the probe with running water. Push the rubber part of the probe to remove liquid inside the rubber part of the probe. Dry the probe thoroughly.

NOTE

After disinfection, the light emitter and the window of the photo detector may be colored, but it does not affect measurement.

Sterilizing

CAUTION

Do not autoclave the probe. It will damage the probe.

If necessary, sterilize the probe with ethylene oxide gas. The sterilizing conditions depend on the contamination of the probe. Refer to the manual of the sterilizing equipment. The following is an example.

Gas:	EO 30% + CO_2 70%	Relative humidity:	50%
EO concentration:	710 mg/L	Pressure:	49 kPa (0.5 kg/cm^2)
Temperature:	45°C, 113°F	Period:	4 to 10 hours

To remove the remaining gas from the probe after sterilization, first decrease the internal pressure of the sterilization equipment to −760 mmHg with a vacuum pump, then add carbon dioxide or antiseptic gas in the equipment. Repeat this procedure at least 5 times. Take the probe out of the sterilization equipment and do not use it for at least 20 days.

Sterilizing the Disposable Probe

CAUTION

- **Never autoclave the probe.**
- **Do not use disposable probes for other patient. If the probe is dirty with blood or bodily fluids, replace it with a new one.**
- **Do not soak the probe in cleaning solution because it is not waterproof.**
- **Do not use any disinfecting alcohol. It may damage the probe.**

The disposable probes are not sterilized. If necessary, sterilize the probe with ethylene oxide gas. These probes can be sterilized only once before use. The sterilizing conditions depend on the contamination of the probe. Refer to the manual of the sterilizing equipment. The following is an example.

Gas:	EO 30% + CO_2 70%	Relative humidity:	50%
EO concentration:	710 mg/L	Pressure:	49 kPa (0.5 kg/cm^2)
Temperature:	45°C, 113°F	Period:	4 to 10 hours

To remove the remaining gas from the probe after sterilization, first decrease the internal pressure of the sterilization equipment to −760 mmHg with a vacuum pump, then add carbon dioxide or antiseptic gas in the equipment. Repeat this procedure at least 5 times. Take the probe out of the sterilization equipment and do not use it for at least 3 days.

After using EOG, ventilate the air thoroughly.

Cleaning and Disinfecting the SpO_2 Connection Cord

NOTE

- **Do not touch the connector pins.**
- **Do not wet the connector.**

Cleaning

Wipe the SpO_2 connection cord with a soft cloth moistened with neutral soap, water or alcohol and wipe with a dry cloth or gauze.

Disinfecting

To disinfect the SpO_2 connection cord, wipe it with a non-abrasive cloth moistened with any of the disinfectants listed below. Use the recommended concentration.

Disinfectant	Concentration (%)
Chlorohexidine gluconate solution	0.5
Benzethonium chloride solution	0.2
Glutaraldehyde solution	2.0
Benzalkonium chloride	0.2
Hydrochloric alkyldiaminoethylglycine	0.5

NIBP

CAUTION

- **Follow the instruction manual of the cuffs and hoses.**
- **Do not wet the connector.**
- **For Nihon Kohden cuffs and hoses, the sterilizer temperature must not exceed 65°C (149°F) because the cuff or hose may deform or melt above this temperature.**

NIBP Cuff Lifetime

Replace the NIBP cuff one year after you start using it. The lifetime of the rubber cuff is approximately 30,000 inflations.

Cleaning and Disinfecting the YP-950T/951T/952T/953T/954T/955T Reusable Cuffs

CAUTION

- **Do not autoclave.**
- **Use only glutaraldehyde solution.**
- **Never allow liquid to get inside the rubber cuff.**
- **Do not sterilize or disinfect the cuff with ultraviolet light or ozone.**

Cleaning

To clean the cuff, carefully pull out the rubber cuff from the cloth cover.

Cloth cover: Wash with neutral detergent and water. Thoroughly dry it.

Rubber cuff: Wipe with a soft cloth or cotton moistened with disinfecting alcohol. Thoroughly dry it.

Disinfecting

To disinfect the cuff, use glutaraldehyde solution. Use the disinfectant of the recommended concentration. Refer to the disinfectant manual for details. After disinfection, clean the cuff as described above.

Cleaning and Disinfecting the Air Hose and Extension Hose

CAUTION

Do not soak the tip of the hose in water. Otherwise, water gets into the hose and correct measurement data cannot be obtained.

NOTE

Do not let any liquid contact the connector.

Cleaning

To clean the hoses, wipe them with a soft cloth moistened with neutral detergent and approx. 40°C (104°F) warm water.

Disinfecting

To disinfect the hoses, wipe them with a soft cloth moistened with either of the disinfectants listed below. Follow the disinfectant instruction and use the recommended concentration.

Disinfectant
Chlorohexidine gluconate solution
Hydrochloric alkyldiaminoethylglycine

Disinfecting the Disposable Cuffs

CAUTION

- **Do not sterilize or disinfect the non-sterilized disposable cuffs for neonates.**
- **Do not reuse disposable cuffs.**

To disinfect disposable cuffs before use, refer to “Disinfecting Disposable Cuffs before Use” in Section 10.

The disposable cuffs for adults, children and infants can be sterilized. To sterilize these cuffs, use glutaraldehyde solution by following its instructions.

Disposal of Cuffs

Follow your local laws for disposing of medical waste.

Cleaning and Disinfecting the Monitor

CAUTION

- **Do not use volatile liquids such as thinner or benzine, because these will cause the materials to melt or crack.**
- **Before cleaning the monitor, turn the monitor power off and disconnect the power cord from the AC SOURCE power cord socket on the rear panel.**
- **After cleaning, make sure that the monitor is completely dried.**
- **Wipe the monitor thoroughly after disinfecting it with spray.**
- **The monitor is not waterproof. Be careful not to let any water get inside the monitor. If the monitor gets wet, take the monitor out of service and contact your Nihon Kohden distributor.**
- **Never sterilize the monitor because the materials may deform, crack or discolor.**

Cleaning the Display

NOTE

- **Do not use a dry or rough cloth.**
- **Do not use acidic, alkaline detergents or alcohol other than ethanol or isopropyl.**

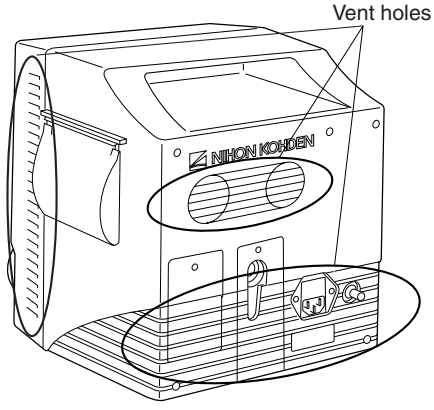
Clean the display using a dry soft cloth or a cloth which is moistened with neutral detergent and wrung out.

Monitor Panel

Cleaning

Clean the surface of the monitor every month with a soft cloth moistened with neutral soap, water or alcohol (76.9 to 81.4%), and wipe with a dry cloth or gauze.

Remove dust from the vent holes on the panels with a cotton swab.



Disinfecting

To disinfect the outside surface of the monitor, wipe it with a non-abrasive cloth moistened with any of the disinfectants listed below. Use the recommended concentration.

Disinfectant	Concentration (%)
Chlorohexidine gluconate solution	0.5
Benzethonium chloride solution	0.2
Glutaraldehyde solution	2.0
Benzalkonium chloride	0.2
Hydrochloric alkyldiaminoethylglycine	0.5

Cleaning the Recorder Unit

CAUTION

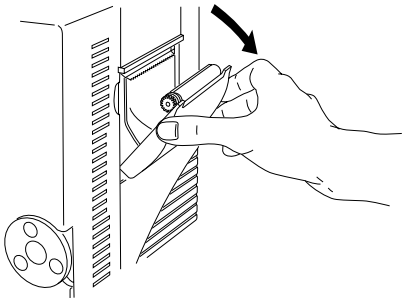
- **Do not touch the head with any hard object. When the head is tapped with a hard object, the head may crack and the heater element wire may break.**
- **Clean the head surface with the provided head cleaner pen before loading new paper. After a period of usage, paper dust may come between the paper and the head surface and good printing cannot be obtained.**
- **Be careful not to cut yourself with the paper cutter on the recorder.**

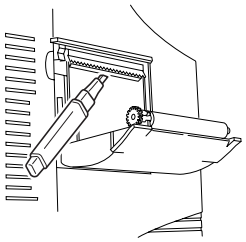
Cleaning the Thermal Head

To protect the thermal head from abrasion or damage and assure optimum performance and long service life, clean the surface of the head with the provided thermal head cleaning pen after every 7 to 10 sets of recording paper.

1. Turn off the monitor before cleaning the thermal head.

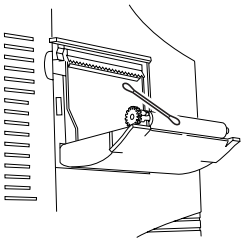
2. Open the recorder door.





3. Clean the black-colored part of the thermal head with the thermal head cleaning pen.

Cleaning the Sensors



The paper empty sensor and mark sensors are located as shown at the left.

Clean the sensor surfaces with a cotton swab.

Yearly Inspection

Check the following items every year to keep your monitor in optimal condition.

- Monitor is not dirty, damaged or rusty.
- No key, rotary dial or switch is broken.
- No loose screws.
- No socket is damaged.
- Power cord is not damaged.
- Grounding lead is properly connected.
- Screen is clean.
- Screen display is correct.
- Clock is correct.
- SYSTEM SETUP settings are correct.
- The specified electrodes, cuffs and probes are used.
- Recorder unit operates properly when used.
- The specified recording paper is used.
- The recorded date is correct.
- Alarm and sync sound can be heard clearly.
- Alarm setting is correct and functions properly.
- Alarm indicator lamps light.
- The sync sound is produced and sync mark is displayed.
- There is no air leak from the NIBP cuff and air hose.
- No current leakage.
- Supplied voltage is correct.
- Measurement accuracy is within the specified range.
- Only the specified parts are used.

Clock Accuracy

At an operating temperature of 25°C, the accuracy of the clock IC of this monitor is about ±3 min per month.

At the storage temperature of between −20 and 65°C, the accuracy of the clock IC of this monitor is about ±5 min per month.

Periodically check that the time in the lower right corner of the monitor screen is correct.

To change the time setting, refer to “Changing Date and Time” in Section 2.

NOTE

The date and time of stored data is not changed when the current date or time is changed during monitoring.

Repair Parts Availability Policy

Nihon Kohden Corporation (NKC) shall stock repair parts (parts necessary to maintain the performance of the instrument) for a period of 6 years after NKC announces discontinuation of the instrument. In that period, NKC or its distributors will repair the instrument. This period may be shorter than 6 years if the necessary board or part is not available. For discontinuation announcements, contact your Nihon Kohden distributor or representative.

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Specifications

Display

Display size:	5.6 inch, TFT type color LCD
Waveform display mode:	Non-fade moving
Viewing area:	114.2 mm × 83.5 mm
Maximum number of waveform trace:	2 traces
Sweep speed:	25 mm/s, respiration waveform 6.25 mm/s
Sweep time:	about 79 mm (at 25 mm/s sweep speed)
Display waveforms:	ECG, respiration, SpO_2 pulse wave
Numerical data display:	Heart rate/pulse rate, respiration rate, NIBP (systolic, diastolic, mean), SpO_2, NIBP measurement time, NIBP measurement mode and current time

Alarm

Alarm items:	Upper/lower limits alarm, apnea alarm, connector disconnection alarm, NOISE alarm, electrode off alarm, pulse waveform detecting alarm, probe off alarm, cuff/ hose check alarm, battery weak alarm, operating environment alarm
Alarm suspend:	Provided for 2 min

ECG

Heart rate counting range:	0, 12 to 300 beats/min
Pacemaker pulse rejection capability:	0.1 to 2.0 ms, ±2 to 700 mV
Defibrillation-proof:	ECG input protected against 400 J
Electrode offset potential tolerance:	±500 mV
Input dynamic range:	± 5 mV
Input impedance:	≥5 MΩ (at 10 Hz)
Frequency response:	0.5 to 20 Hz 50 or 60 Hz
Lead:	I, II, III
Waveform display:	
Display sensitivity:	10 mm/mV ±5% (at ×1 sensitivity)
Sensitivity control:	×1/4, ×1/2, ×1, ×2, ×4, or AUTO
Pacing spike display:	Available
Alarm items:	
Upper limit range:	20 to 300 beats/min in 5 beats/min steps, OFF
Lower limit range:	OFF, 15 to 295 beats/min in 5 beats/min steps

Respiration (Transthoracic impedance pneumography)

Respiration counter counting range:	0 to 150 breaths/min
Waveform display:	
Display sensitivity:	10 mm/Ω
Sensitivity control:	×1/4, ×1/2, ×1, ×2, ×4
Alarm:	
Upper limit range:	2 to 150 breaths/min in 2 breaths/min steps, OFF
Lower limit range:	OFF, 0 to 148 breaths/min in 2 steps
Apnea time:	OFF, 5 to 40 s in 5 s steps

SpO_2

Measuring range:	0 to 100%
Pulse rate counting range:	30 to 300 beats/min
SpO_2 accuracy:	Monitor only: ±1 digits (80% ≤ SpO_2 ≤ 100%), ±2 digits (50% ≤ SpO_2 < 80%)
	With probe: ±2 digits (80% ≤ SpO_2 ≤ 100%), ±3 digits (70% ≤ SpO_2 < 80%)
Waveform sensitivity:	×1/8, ×1/4, ×1/2, ×1, ×2, ×4, ×8 or AUTO
Alarm:	
Upper limit range:	51 to 100% SpO_2 in 1% SpO_2 steps, OFF
Lower limit range:	OFF, 50 to 99% SpO_2 in 1% SpO_2 steps

Non Invasive Blood pressure, NIBP

Measuring range:	0 to 300 mmHg
Accuracy:	±3 mmHg (0 mmHg ≤ NIBP < 200 mmHg)
	±4 mmHg (200 mmHg ≤ NIBP ≤ 300 mmHg)
Safety:	
Cuff inflation maximum pressure:	Adult 300 to 330 mmHg
	Neonate 150 to 165 mmHg
Cuff inflation time limiter:	Adult ≤180 s
	Neonates ≤90 s
Measurement mode:	Manual
	STAT (continuous)
	Automatic (periodic), PWTT
Alarm:	
Upper limit range:	15 to 260 mmHg in 5 mmHg steps, OFF
Lower limit range:	OFF, 10 to 255 mmHg in 5 mmHg steps

Trendgraph

Trend parameters:	NIBP (systolic, diastolic and mean), heart rate/pulse rate, SpO_2, respiration rate
Trend display width:	30 min, 1, 2, 4, 8, or 24 h

Vital Signs List

Parameters:	Listed time, NIBP (systolic, diastolic and mean), heart rate (or pulse rate), SpO_2, respiration rate
Maximum number of files in list:	400

Recording (optional, RG-101W)

Recording method:	Thermal array recording
Recording width:	≥48 mm
Paper speed:	25, 12.5, 6.25 mm/s
Recording sensitivity:	10 mm/mV (at SENS × 1)

Power Requirement

Line voltage:	AC 100 to 240 V ± 10%
Line frequency:	50 or 60 Hz
Battery pack (NKB-302):	DC 9.6 V

Environment

Operating environment	
Temperature:	10 to 40°C

Humidity:	30 to 85% RH (non-condensing)
Atmospheric pressure:	70 to 106 kPa

Storage environment

Temperature:	–20 to +65°C
	–15 to +55°C (Recording paper)
Humidity:	10 to 95% RH (non-condensing)
Atmospheric pressure:	70 to 106 kPa

Dimensions and Weight (approximate)

Dimensions:	195 mm W × 205 mm H ×185 mm D
Weight:	4.0 kg (excluding options)

Electromagnetic Compatibility

IEC60601-1-2 (1993) – Collateral Standard: Electromagnetic compatibility – Requirement and tests

Emissions:	CISPR11 Group 1, Class B

Safety Standard

Safety standard:	IEC 60601-1 (1988) Amendment 1 (1991), Amendment 2 (1995)
	IEC 60601-1-1 Amendment 1 (1995)
	IEC 60601-2-27 (1994) - Particular requirements for the safety of electrocardiographic monitoring
	IEC 60601-2-30 (1995) - Particular requirements for the safety of automatic cycling in in-direct blood pressure monitoring equipment

According to the type of protection against electrical shock:

CLASS I EQUIPMENT (AC Powered)

Internally Powered EQUIPMENT (BATTERY Powered)

According to the degree of protection against electrical shock

ECG, Respiration (impedance):	Defibrillator-proof type CF applied part
SpO_2, NIBP:	Defibrillator-proof type BF applied part

According to the degree of protection against harmful ingress of water:

IPX0 (ordinary EQUIPMENT)

According to the degree of safety of application in the presence of FLAMMABLE ANAESTHETIC MIXTURE WITH AIR, OR WITH OXYGEN OR NITROUS OXIDE:

Equipment not suitable for use in the presence of FLAMMABLE ANAESTHETIC MIXTURE WITH AIR, OR WITH OXYGEN OR NITROUS OXIDE

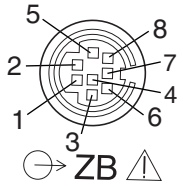
According to the mode of operation: CONTINUOUS OPERATION

Input/Output Socket Pin Assignment

WARNING

Connect only the specified instruments to the connector or sockets marked with ⚠ by following the specified procedure. Otherwise, electrical leakage current may harm the patient and operator.

ZB Socket



Pin No.	Signal	Pin No.	Signal
1	ZB_RSPW	5	ZB_XRST
2	E2	6	ZB_XINIT
3	ZB_XCNFN	7	ZB_XTXD
4	ZB_UDD (+5 V)	8	ZB_XRXD

General Requirements for Connecting Medical Electrical System

When more than one electrical instrument is used, there may be electrical potential difference between the instruments. Potential difference between instruments may cause current to flow to the patient connected to the instruments, resulting in electrical shock (micro shock). Therefore, electrical instruments must be appropriately installed as specified in IEC60601-1-1.

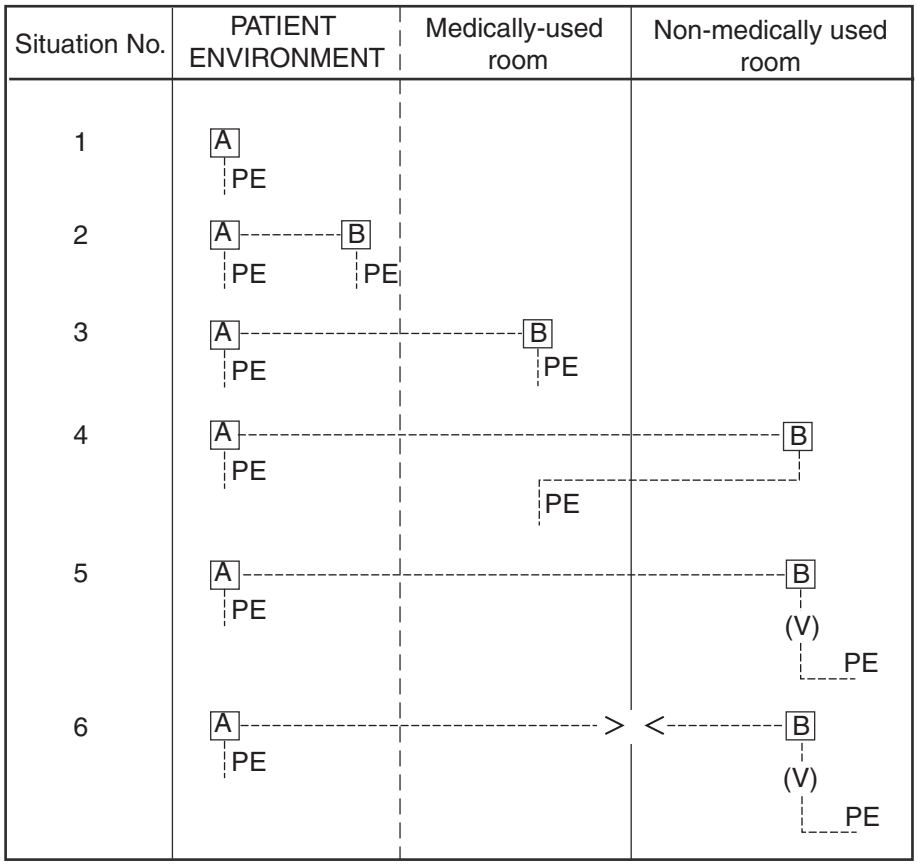
The following is an extract from IEC60601-1-1 "Medical electrical equipment Part 1: General requirements for safety". For details, refer to IEC60601-1-1 and consult with a biomedical engineer.

Examples of combinations of MEDICAL ELECTRICAL EQUIPMENT and non-medical electrical equipment

Situation No.	Equipment A	Equipment B	Solution
1	IEC 60601/X		OK
1a	IEC XXXXX		OK, if ENCLOSURE LEAKAGE CURRENT is less than 0.5 mA. If the ENCLOSURE LEAKAGE CURRENT is more than 0.5 mA: Solution *Q* (separating transformers).
2a	IEC 60601/X	IEC 60601/B	OK
2b	IEC 60601/F	IEC XXXXX	for B any one of *P*, *Q*, *R*
2c	IEC 60601/B	IEC XXXXX	for A solution *P* for B any one of *P*, *Q*, *R*
3a	IEC 60601/X	IEC 60601/B	OK
3b	IEC 60601/F	IEC XXXXX	OK
3c	IEC 60601/B	IEC XXXXX	for A solution *P*
4	See 3a, 3b, 3c		
5a	IEC 60601/X	IEC 60601/B	for A solution *P* or *S* (groundloop possible)
5b	IEC 60601/X	IEC XXXXX	for A solution *P* or *S* (groundloop possible)
6a	IEC 60601/X	IEC 60601/X	OK (with *S*)
6b	IEC 60601/X	IEC XXXXX	OK (with *S*)

IEC 60601/B = IEC 60601-1 EQUIPMENT of TYPE B **with** PATIENT connection
IEC 60601/F = IEC 60601-1 EQUIPMENT of TYPE BF or TYPE CF (or TYPE B **without** PATIENT connection)
IEC 60601/X = IEC 60601-1 EQUIPMENT of TYPE B or TYPE BF or TYPE CF
IEC XXXXX = Equipment complying with e.g. IEC 348, IEC 950 etc.

P: additional protective earth
Q: additional separating transformer
R: floating power supply
S: separation



Legend:

(V) = Potential difference between different localities.

>< = SEPARATION DEVICE.

PE = Protective earth.

Options and Consumables

Optional Accessory Kit

NOTE

- **Use only Nihon Kohden specified parts and accessories to assure maximum performance from your instrument.**
- **When ordering the following accessories and options, specify the supply code no. When the supply code no. is not provided with the accessory, specify the code no.**

There are following accessory kits, grouped according to the power supply area and ECG lead type.

Model / Items	**YZ-023H5*** (100 V/IEC type)	**YZ-023H6** (200 V/IEC type)	**YZ-023H7*** (GB/IEC type)	**YZ-023H8*** (100 V/AHA type)
Power cord W	✓	×	×	✓
Power cord N	×	✓	×	×
Power cord GB AC	×	×	✓	×
ECG electrode lead (3 electrodes)	BR-903P	BR-903P	BR-903P	BR-903PA
ECG connection cord (3 electrodes)	JC-103T	JC-103T	JC-103T	JC-103TA
SpO_2 connection cord, JL-302T	✓	✓	✓	✓
Air hose for adult/child (3.5 m), YN-101T	✓	✓	✓	✓
Cuff for adult, YP-953T	✓	✓	✓	✓
Cuff for child, YP-952T	✓	✓	✓	✓

* The CE mark does not apply to these parts.

Options for the Monitor

Name	Qty	Code No.	Supply Code No.
Grounding lead	1	544582A	—
Fuse T2.0 A/250 V	1	104522	—
Battery pack	1	NKB-302	—
Transmitter	1	ZB-900PK*	—
Cart	1	KC-012P	—
Recorder unit	1	RG-101W	—
Alarm pole	1	YL-001P	—

* The CE mark does not apply to the ZB-900PK transmitter.

For ECG and Respiration (Impedance Method) Monitoring

Name	Purpose	Length (m)	Qty	Code No.	Supply Code No.
Electrode lead	IEC, clip type	0.8	1	BR-903P	K911
	AHA, clip type			BR-903PA	K911A
	IEC, snap type			BR-913P	K910
	AHA, snap type			BR-913PA	K910B
ECG connection cord	IEC	3		JC-103T	L060
	AHA			JC-103TA	—
Disposable electrodes, Vitrode	General	—	30 × 5	Bs-150*	G201
				C-150	G204
			3 × 50	F-150M*	G210D
			30 × 20	G-600	G221
			30 × 5	J-150	G250
	General with DIN type lead	10 cm	3 × 30	V-090M3*	G272A
		15 cm		V-091O3*	G278A
	General, autoclave possible	—	3 × 30	D-90*	G217
	For neonates and premature infants For NICU	15 cm	3 × 50	F-150S*	G210C
	For neonates and premature infants For NICU With DIN type lead	60 cm	3 × 40	V-120S3*	G271A
			3 × 10	N-03IS3*	G300A

* These parts have not been checked for compliance with the MDD (Medical Device Directive). For EC member countries, Nihon Kohden recommends the use of parts that comply with MDD.

For SpO_2 Monitoring

Name	Length (m)	Qty	Code No.	Supply Code No.
SpO_2 connection cord	2.5	1	JL-302T	L311
Finger probe	1.6		TL-201T	P225F
			TL-101T	P224A
Multi-site probe			TL-120T	P225C
Foot probe			TL-121T	P225D
Disposable probe (For adults)		5	TL-251T	P201A
Disposable probe (For children)			TL-252T	P201B
Disposable probe (For neonates)			TL-253T	P201C
Disposable probe (For adults and neonates)	0.8		TL-051S	P228A
	1.6		TL-052S	P228B
Disposable probe (For adults, children and infants)	0.8		TL-061S	P229A
	1.6		TL-062S	P229B
COTTONY tape	—	20	340703	P259
Foam tape for TL-051S/052S/061S/062S disposable probes		4 × 25	—	P260

For NIBP Monitoring

Name		Width (cm)	Length (m)	Qty	Code No.	Supply Code No.
Air hose for adults/children		—	1.5	1	YN-100T	S929A
			3.5		YN-101T	S929B
Extension air hose			1.5		YN-990P	S903
Cuff for infants		5	0.15		YP-950T*	S939A
Cuff for children	Small	7			YP-951T*	S939B
	Standard	10			YP-952T*	S939C
Cuff for adult	Standard	13			YP-953T*	S940B
	Large	15			YP-954T*	S940C
Cuff for thigh		19			YP-955T*	S940D
Disposable cuff for infants		6	0.2	20	YP-910P	—
Disposable cuff for children		9			YP-912P	—
Disposable cuff for adults	Small	12			YP-913P	—
	Standard	14			YP-914P	—
	Large	16			YP-915P	—
	Extra large	20			YP-916P	—
Air hose for neonates		—	1.5	1	YN-120T	S930A
			3.5		YN-121T	S930B
Disposable cuff for neonates	#20	2.5	0.15	10	YP-920P	—
	#21	3			YP-921P	—
	#22	4			YP-922P	—
	#23	5			YP-923P	—
Sterilized disposable cuffs for neonates	No. 11	3	0.21	1	YP-111P**	S260
	No. 12	4			YP-112P**	S260A
	No. 13	5			YP-113P**	S260B

CAUTION

*** These Products Contain Natural Rubber Latex Which May Cause Allergic Reactions.**

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For RG-101W Recorder Unit

Name	Qty	Code No.	Supply Code No.
Thermal head cleaner pen	5	Y-011	Y011
Recording paper	1	QW60-2	A810

Signal Level Sheet

When you first use a new probe, check it referring to the service manual and write down the signal level in the table below.

No.	Probe Model	Serial No.	Date of First Use	Original Signal Level	
				R	IR
1	TL-				
2	TL-				
3	TL-				
4	TL-				
5	TL-				
6	TL-				
7	TL-				
8	TL-				
9	TL-				
10	TL-				
11	TL-				
12	TL-				
13	TL-				
14	TL-				
15	TL-				
16	TL-				
17	TL-				
18	TL-				
19	TL-				
20	TL-				
21	TL-				
22	TL-				
23	TL-				
24	TL-				
25	TL-				